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of Attorneys for Plaintiff
Watermark Paddlesports, Inc.

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

WATERMARK PADDLESPORTS, INC., a Delaware corporation,

Plaintiff,

v.

CEQUENT TOWING PRODUCTS, INC., a Delaware corporation,

Defendant.

Case No. CV '05 0082 AA

COMPLAINT FOR PATENT INFRINGEMENT

DEMAND FOR JURY TRIAL

For its complaint, plaintiff Watermark Paddlesports, Inc. ("Watermark") alleges against defendant Cequent Towing Products, Inc. ("Cequent") as follows:

THE PARTIES

1. Plaintiff Watermark is a corporation duly organized and existing under the laws of the State of Delaware, located and having headquarters at 12725 SW Millikan Way, Suite 338, Beaverton, Oregon 97005.

2. Defendant Cequent Towing Products, Inc. is, upon information and belief, a Delaware corporation having an office at 47774 Anchor Court West, Plymouth, MI 48170.

JURISDICTION

3. The claim of plaintiff arises under the laws of the United States relating to patents, Title 35 of the United States Code. Diversity exists between the parties and the amount in dispute exceeds seventy five thousand dollars ($75,000). Therefore, this Court has jurisdiction of this action under 28 USC §§ 1331, 1332 and 1338(a).

VENUE

4. Venue is proper in this district pursuant to 28 USC § 1391(b) (2) and (c) because a substantial part of the events giving rise to the claim occurred here. In addition, upon information and belief, a substantial part of property that is the subject of this action is situated here.

5. On information and belief, Cequent sells a substantial volume of equipment in Oregon each year. Personnel from Cequent, on information and belief, come into Oregon on a regular basis to conduct business.

BACKGROUND

6. Watermark is the owner of U.S. Patent No. 6,431,423 ("the '423 Patent"). The '423 Patent issued on August 13, 2002, and is entitled "Assembly for Carrying a Bicycle on a Vehicle." A copy of this patent is appended hereto as Exhibit A.

7. The application from which the '423 Patent issued was filed on May 17, 2000 as a continuation-in-part of U.S. patent application Ser. No. 09/556,878, filed April 19, 2000, which is a continuation-in-part of U.S. patent application Ser. No. 09/505,056 filed February 16, 2000, which is a continuation-in-part of U.S. patent application Ser. No. 09/447,908, filed November 23, 1999. The U.S. Patent and Trademark Office examined the application, determined that the

claimed apparatus for carrying a bicycle on a vehicle met all of the criteria for patentability, and awarded the '423 Patent. The patent is currently in force, is valid, and is enforceable. The patent gives Watermark the right to exclude others from making, using, importing, selling, or offering for sale the claimed invention throughout the United States.

8. Watermark is the owner of U.S. Patent No. 6,467,664 ("the '664 Patent"). The '664 Patent issued on October 22, 2002, and is entitled "Bicycle Carrier." A copy of this patent is appended hereto as Exhibit B.

9. The application from which the '664 Patent issued was filed on September 10, 2001 as a continuation of U.S. patent application Ser. No. 09/466,223, filed December 17, 1999. The U.S. Patent and Trademark Office examined the application, determined that the claimed bicycle carrier met all of the criteria for patentability, and awarded the '664 Patent. The patent is currently in force, is valid, and is enforceable. The patent gives Watermark the right to exclude others from making, using, importing, selling, or offering for sale the claimed invention throughout the United States.

10. The '423 Patent and the '664 Patent were issued in the name of Yakima Products, Inc. Yakima Products, Inc. merged into Watermark Paddlesports, Inc. on December 20, 2002, and the appropriate assignments to Watermark were recorded with the United States Patent and Trademark Office soon thereafter.

11. Products covered by the '423 Patent and the '664 Patent have been sold by Watermark, and are now being sold by Watermark. Such products have been marked with U.S. Patent No. 6,431,423, since shortly after the issuance of the '423 Patent, and products have been marked with U.S. Patent No. 6,467,664 since shortly after the issuance of the '664 Patent.

INFRINGEMENT OF THE '423 PATENT

12. Upon information and belief, Cequent has made, used, sold, offered for sale, imported and/or is making, using, selling, importing and/or offering for sale bicycle carriers, including bicycle carriers sold under the label "Reese®," that infringe the '423 Patent.

INFRINGEMENT OF THE '664 PATENT

13. Upon information and belief, Cequent has made, used, sold, offered for sale, imported and/or is making, using, selling, importing and/or offering for sale bicycle carriers, including bicycle carriers sold under the label "Reese®," that infringe the '664 Patent.

WILLFUL INFRINGEMENT OF THE '423 PATENT AND THE '664 PATENT

14. On information and belief, Cequent's infringement of the '423 Patent and the '664 Patent is willful and will continue. Defendant's acts have caused and are causing severe and irreparable damage to Watermark, and Watermark has no adequate remedy at law.

PRAYER FOR RELIEF

WHEREFORE, Watermark demands judgment:

1. For a decree that Cequent has infringed the '423 Patent;

2. For a decree that Cequent has infringed the '664 Patent;

3. For a preliminary and permanent injunction restraining and enjoining Cequent, their agents, servants, employees, officers, and those persons in active concert or participation with Cequent, from further infringement of the '423 Patent and the '664 Patent pursuant to 35 USC § 283;

4. For an accounting and damages against Cequent for all damages suffered by Watermark by reason of infringement of the '423 Patent, including lost profits, but in any event no less than a reasonable royalty, together with interest and costs pursuant to 35 USC § 284;

5. For an accounting and damages against Cequent for all damages suffered by Watermark by reason of infringement of the '664 Patent, including lost profits, but in any event no less than a reasonable royalty, together with interest and costs pursuant to 35 USC § 284;

6. For damages in an amount equal to three times the amount of damages found or assessed, to compensate Watermark for the willful, deliberate and intentional acts of infringement of the '423 Patent by Cequent pursuant to 35 USC § 284;

7. For damages in an amount equal to three times the amount of damages found or assessed, to compensate Watermark for the willful, deliberate, and intentional acts of infringement of the '664 Patent by Cequent pursuant to 35 USC § 284;

8. For an award of reasonable attorney fees against Cequent pursuant to 35 USC § 285; and

9. For such other and further relief as may be just and proper.

DEMAND FOR JURY TRIAL

Plaintiff hereby demands a trial by jury of all issues so triable.

Dated this 19th day of January, 2004.

Respectfully submitted,

KOLISCH HARTWELL, P.C.

By /s/ Peter E. Heuser
Peter E. Heuser
of Attorneys for Plaintiff Watermark Paddlesports, Inc.

US006431423B1

(12) **United States Patent**
Allen et al.

(10) **Patent No.: US 6,431,423 B1**
(45) **Date of Patent: Aug. 13, 2002**

(54) **ASSEMBLY FOR CARRYING A BICYCLE ON A VEHICLE**

(75) Inventors: **Scott R. Allen**, Fieldbrook; **Stephen J. Cole**, Arcata; **Gregory A. Dean**; **Duncan G. Robins**, both of McKinleyville; **Joseph J. Settelmayer**, Fieldbrook, all of CA (US)

(73) Assignee: **Yakima Products, Inc.**, Arcata, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/574,677**

(22) Filed: **May 17, 2000**

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/556,878, filed on Apr. 19, 2000, which is a continuation-in-part of application No. 09/505,056, filed on Feb. 16, 2000, which is a continuation-in-part of application No. 09/447,908, filed on Nov. 23, 1999, now Pat. No. 6,283,310, and a continuation-in-part of application No. 09/466,233, filed on Dec. 17, 1999, now Pat. No. 6,286,738.

(51) **Int. Cl.**[7] **B60R 9/06**

(52) **U.S. Cl.** **224/509**; 224/324; 224/533; 224/537; 224/924

(58) **Field of Search** 224/924, 501, 224/502, 509, 533, 537, 324

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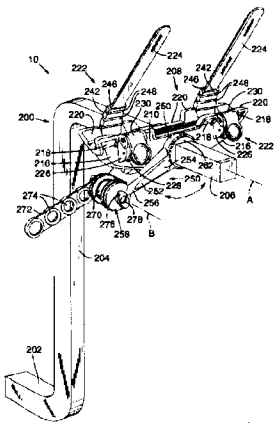
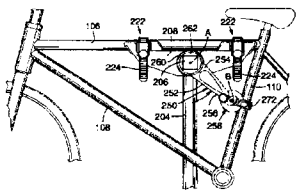
Primary Examiner—Stephen P. Garbe
(74) *Attorney, Agent, or Firm*—Kolisch Hartwell Dickinson McCormack & Heuser

(57) **ABSTRACT**

A rack assembly for carrying recreational equipment on a vehicle. The assembly includes at least one mount attachable to the vehicle, and a load-carrying support member coupled to the mount and configured to support the recreational equipment adjacent the vehicle. At least one securing apparatus is associated with the load-carrying support member and configured to secure the equipment to the support member. The securing apparatus includes a strap adapted to extend at least partially around the recreational equipment, and a ratchet drive mechanism adapted to receive and grip one end of the strap. In one embodiment, the ratchet drive mechanism includes at least one drive actuator that is operable to grip successive portions of the strap and draw it tight around the recreational equipment.

39 Claims, 8 Drawing Sheets





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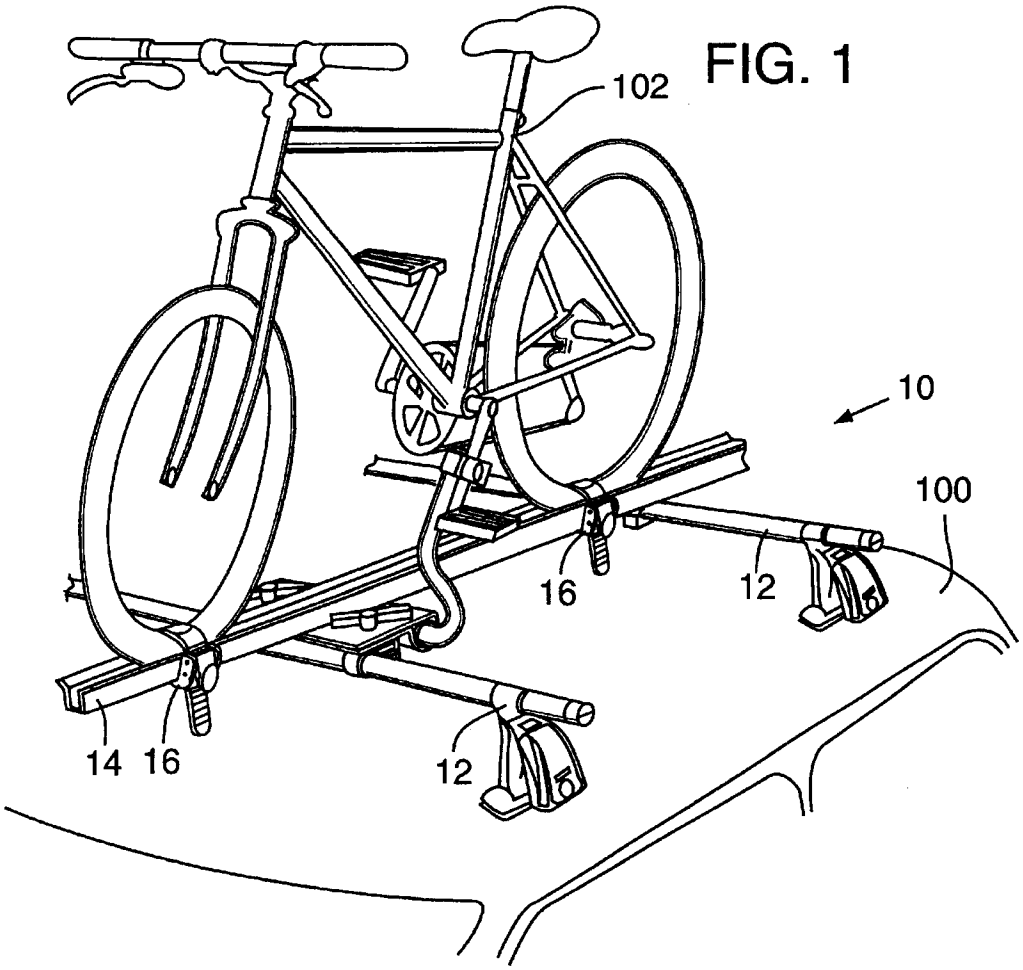

FIG. 1

FIG. 2

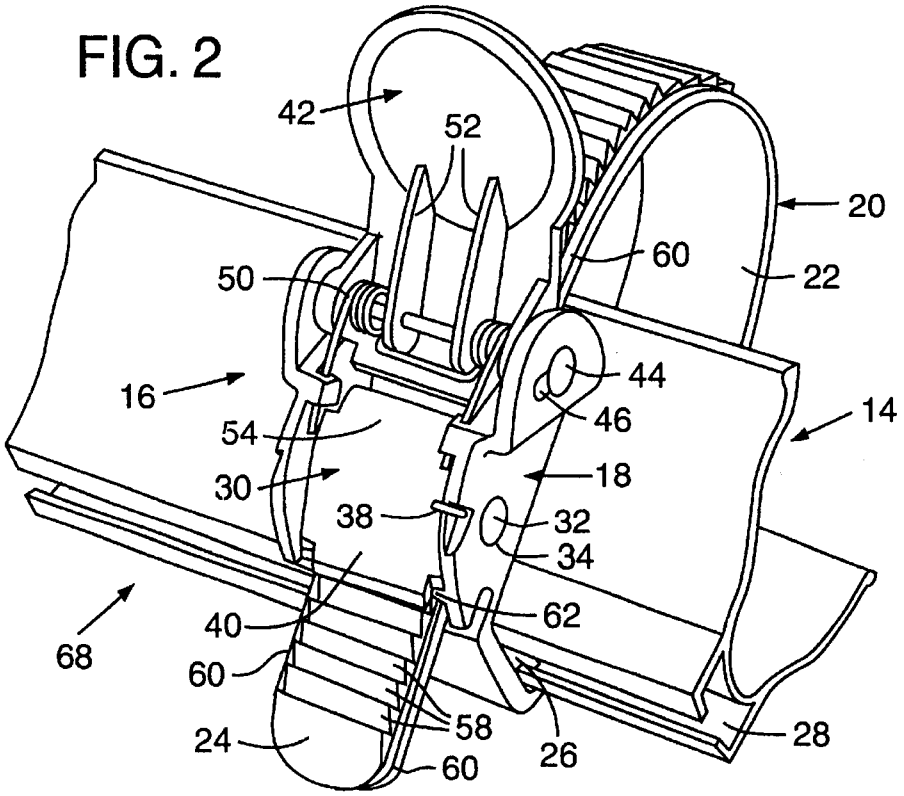
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FIG. 3

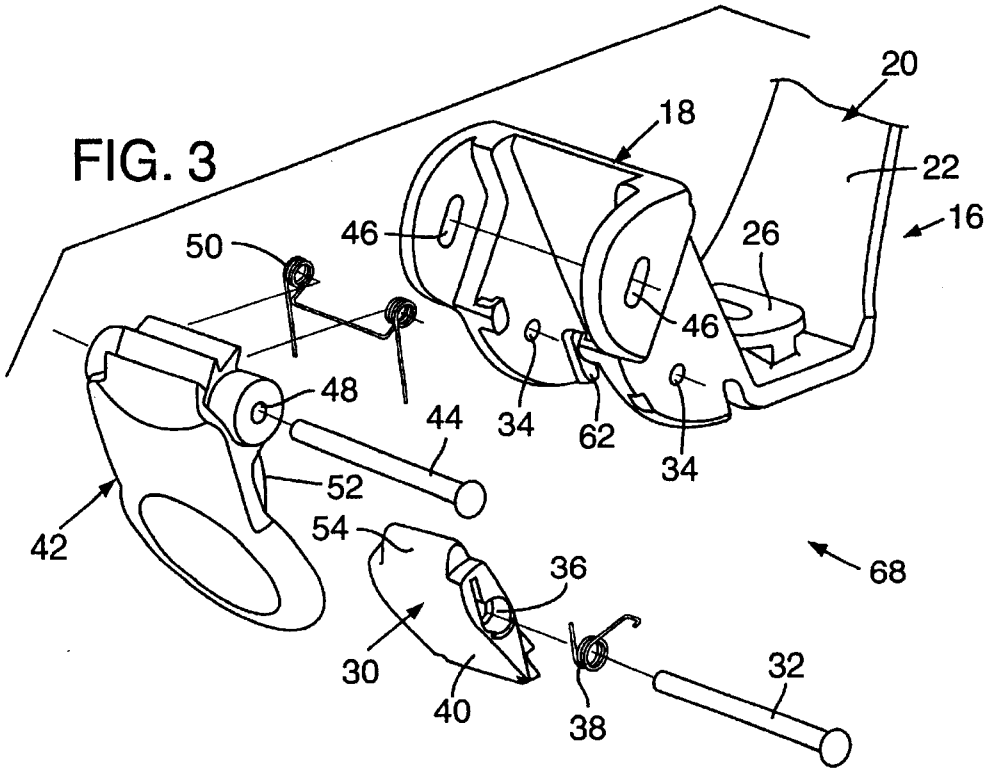
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FIG. 4

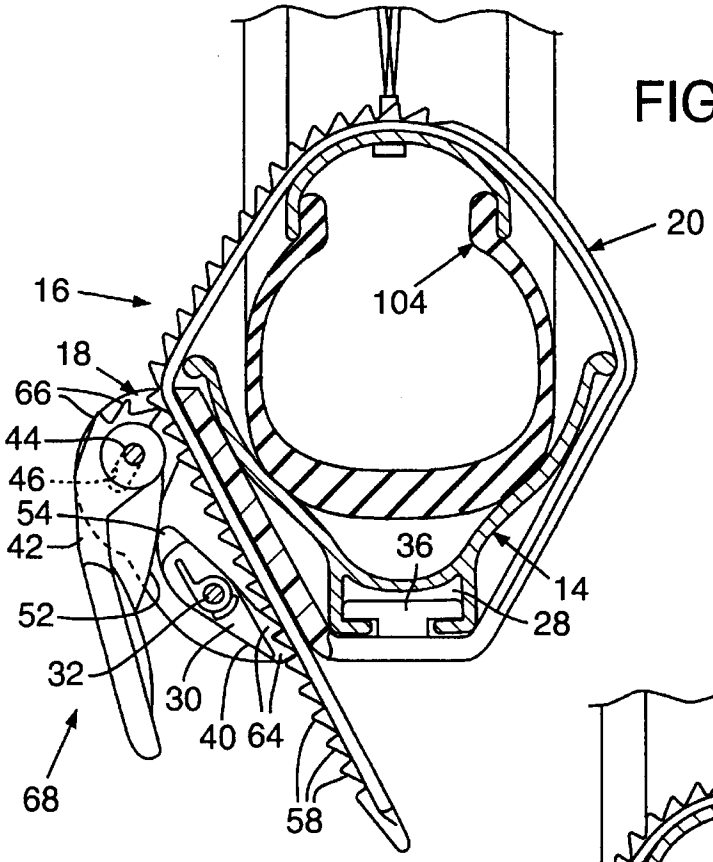
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FIG. 5

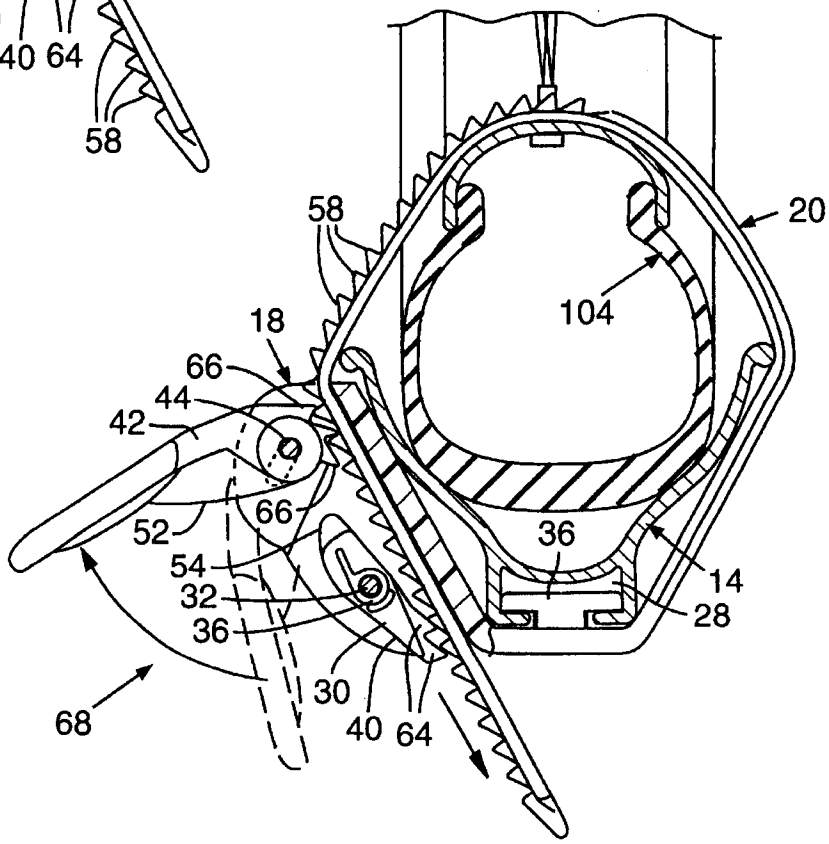
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FIG. 7

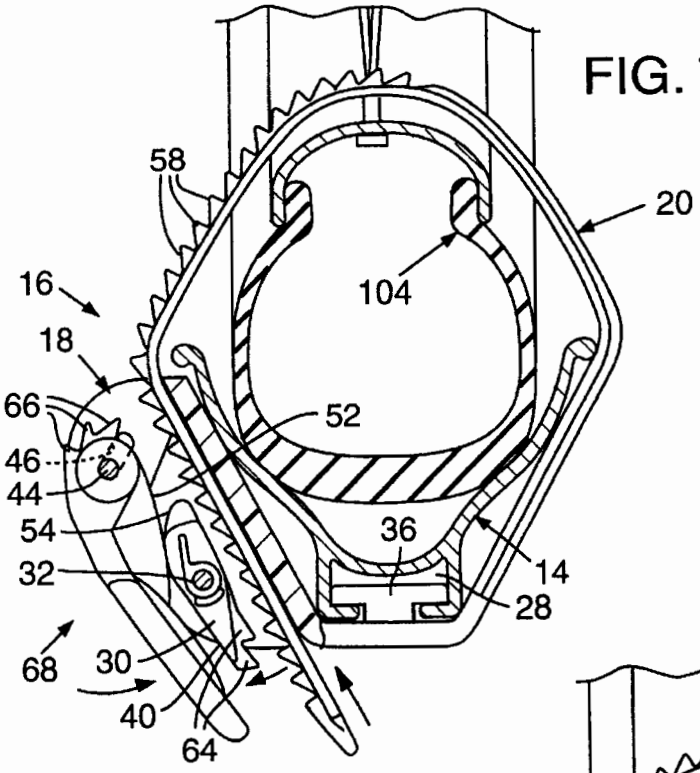
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FIG. 6

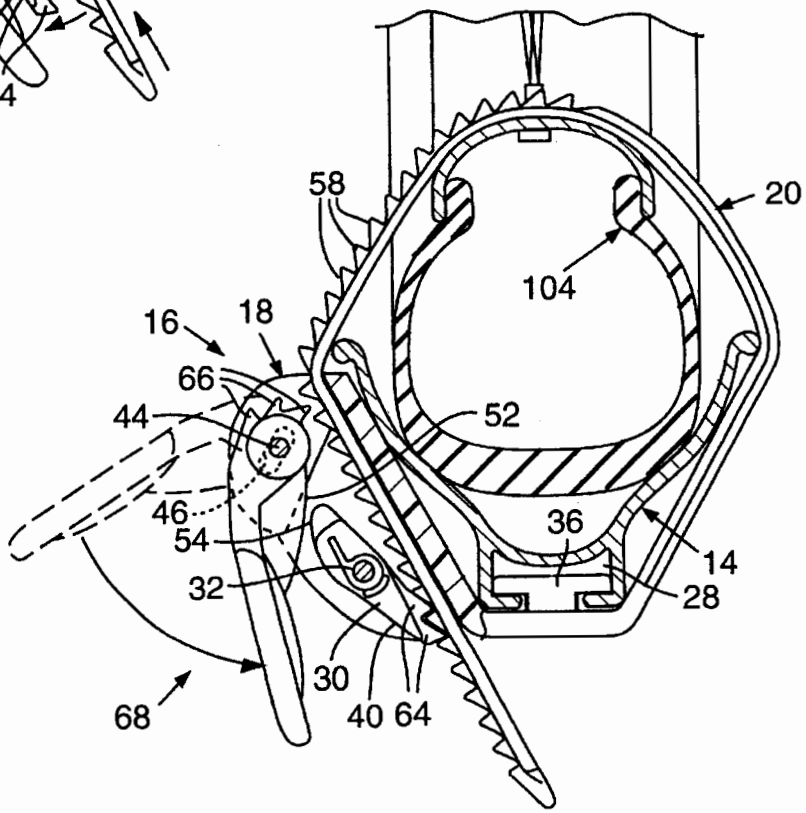
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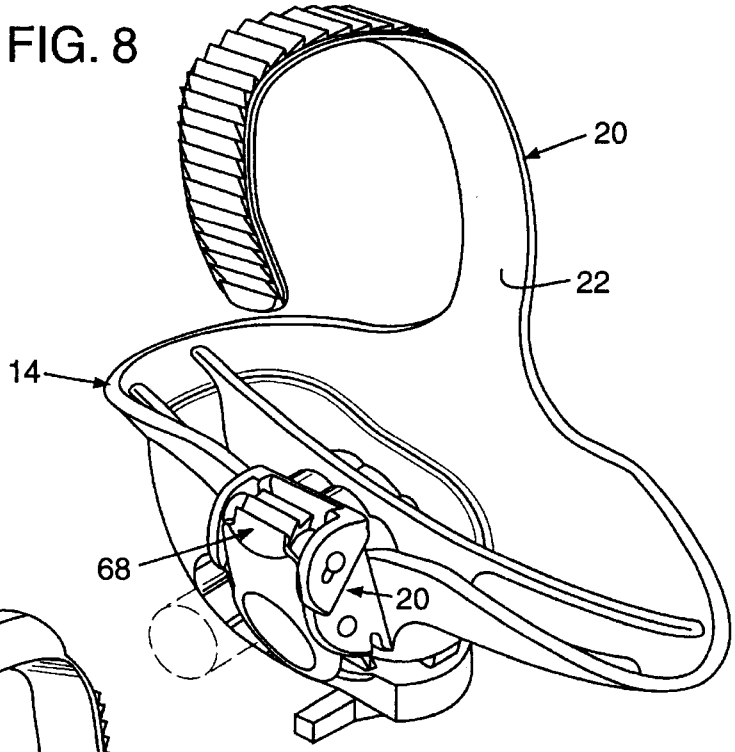
FIG. 8



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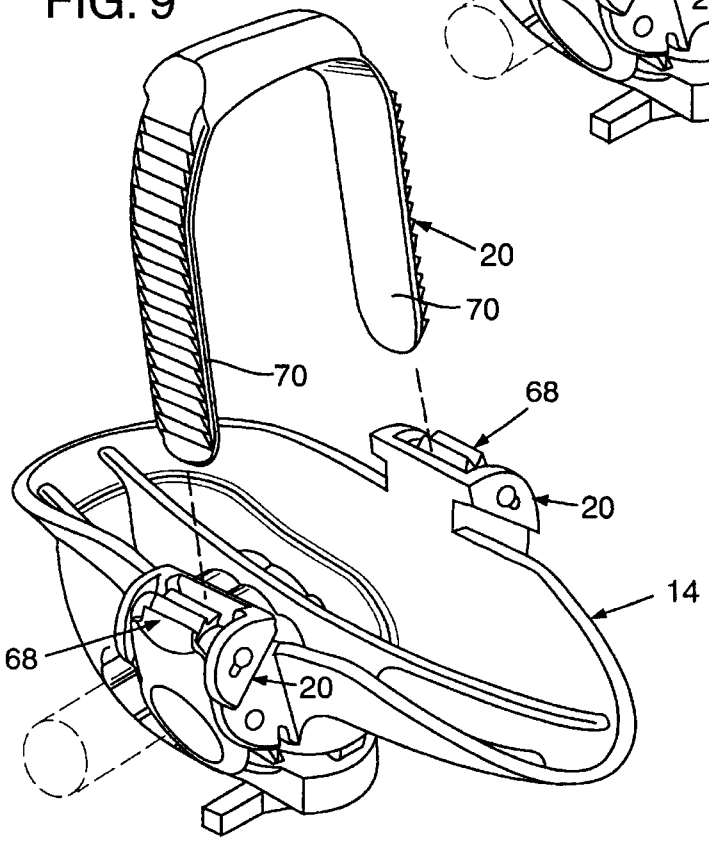
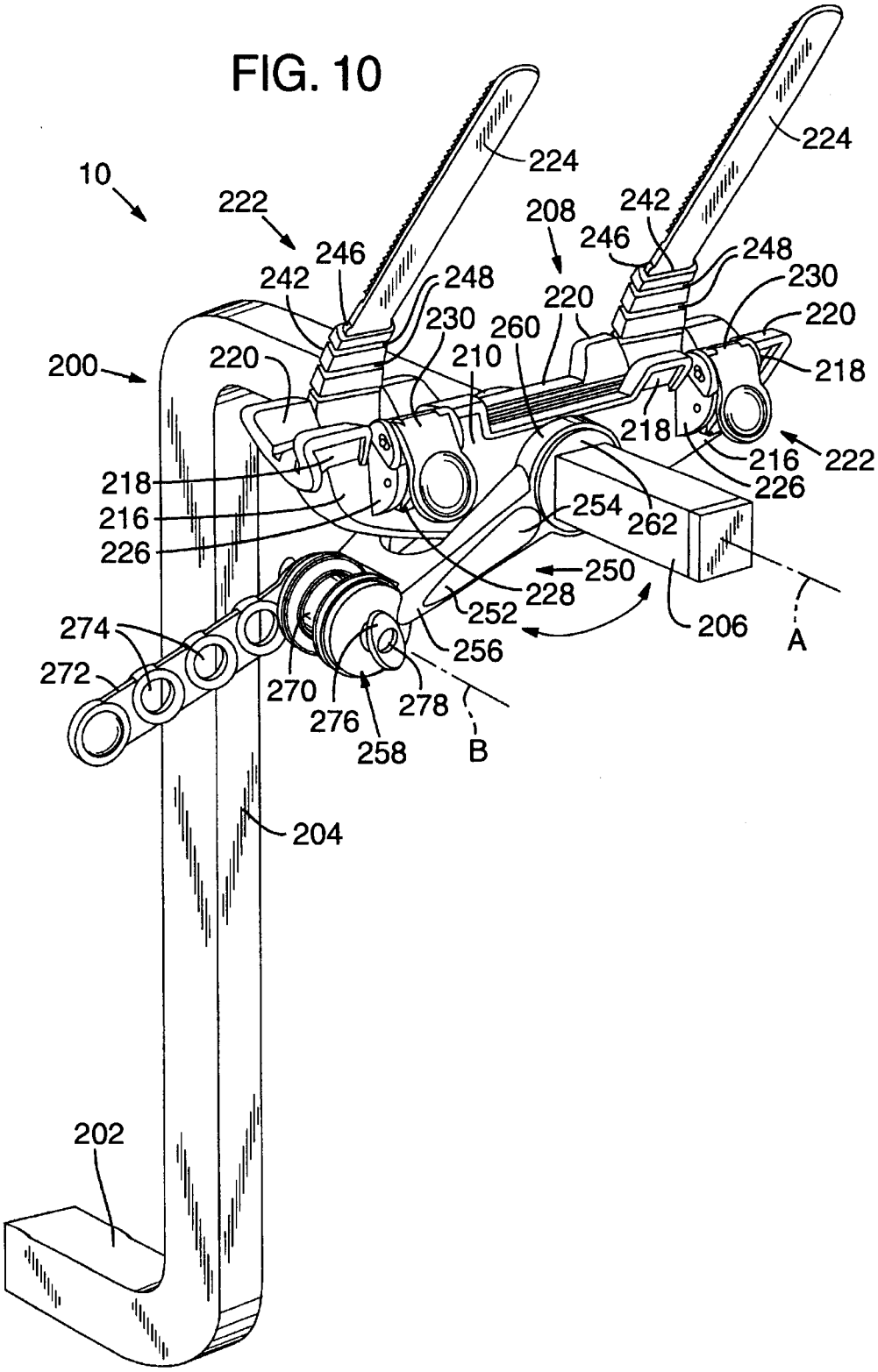


FIG. 10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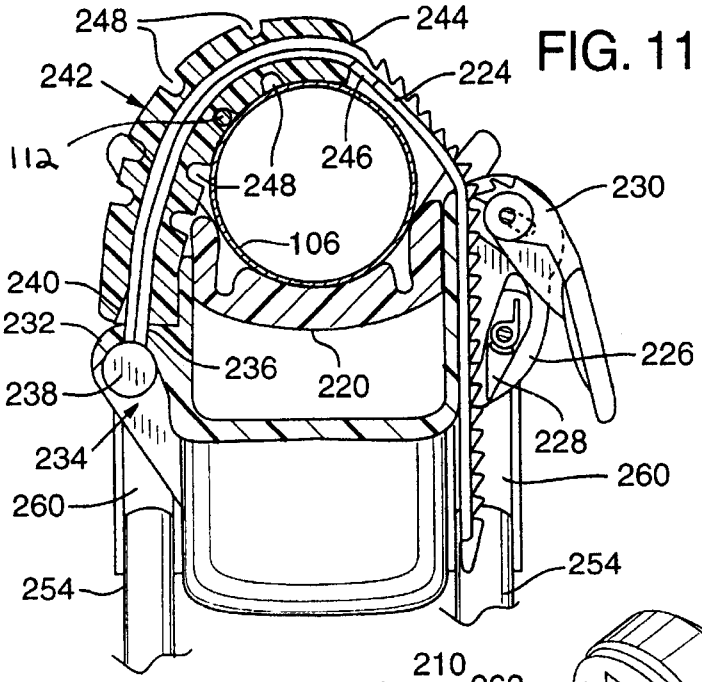
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FIG. 11

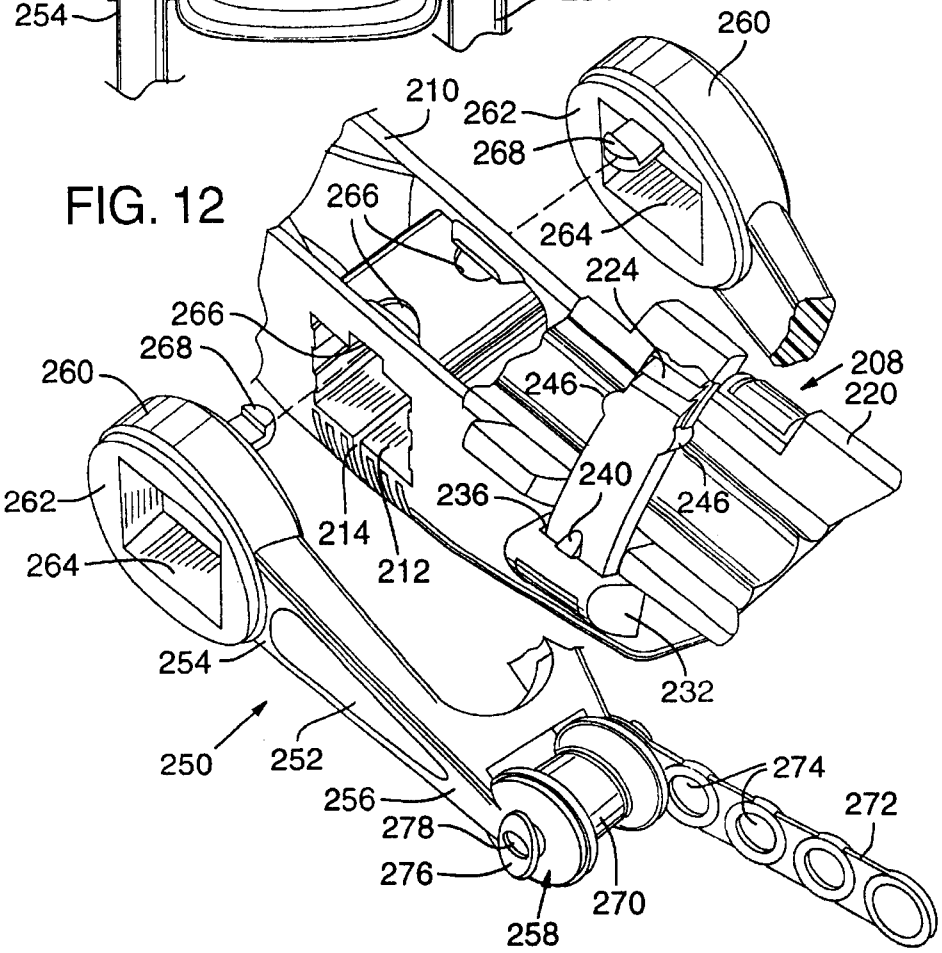
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FIG. 12

FIG. 13

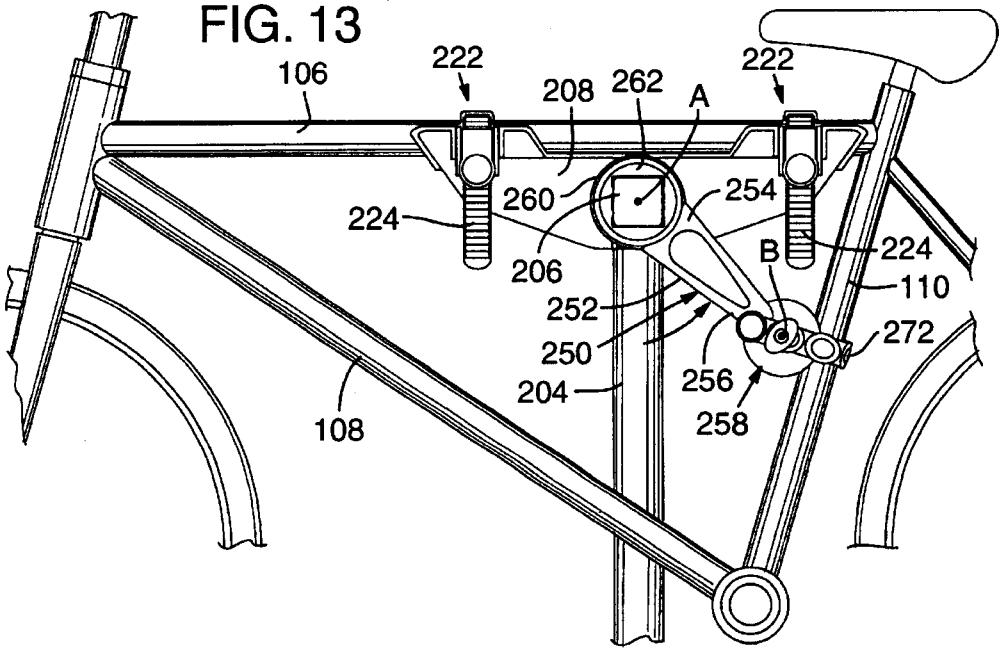
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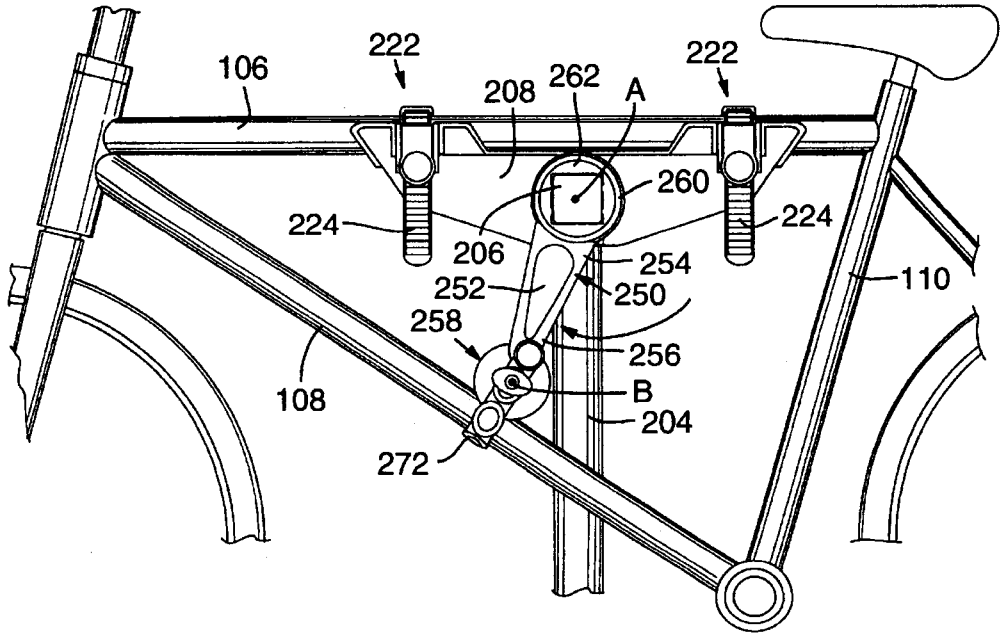
FIG. 14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ASSEMBLY FOR CARRYING A BICYCLE ON A VEHICLE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. patent application Ser. No. 09/556,878, filed Apr. 19, 2000, which is a continuation-in-part of U.S. patent application Ser. No. 09/505,056 filed Feb. 16, 2000 which is a continuation-in-part of U.S. patent application Ser. No. 09/447,908, filed Nov. 23, 1999 now U.S. Pat. No. 6,283,310. This application is also a continuation-in-part of U.S. patent application Ser. No. 09/466,233, filed Dec. 17, 1999 now U.S. Pat. No. 6,286,738. All of the above-identified patent applications are hereby incorporated by reference.

FIELD OF THE INVENTION

The present invention relates to vehicle racks, and more particularly to a rack assembly for carrying a bicycle on a vehicle having a rear hitch-mount.

BACKGROUND

The popularity of recreational cycling has grown substantially in recent years. As a result, the demand for bicycle carriers to transport bikes on cars and other vehicles has also grown.

There are various types of vehicle-mountable bicycle racks available. One type is mountable on the rear hitch-mount of a vehicle to carry one or more bicycles adjacent the rear of the vehicle. These type racks are usually configured to receive and hold the top tube of a bicycle. One or more straps may be positioned around the bicycle to secure it to the rack. Typically, the straps must be pulled tightly around the bicycle to hold it securely during normal driving speeds and conditions. Some users may find it difficult to apply sufficient tension to the strap. In addition, some users may find it difficult to secure the strap while maintaining the desired tension. Furthermore, even normal acceleration or deceleration of the vehicle can cause the bicycles to swing or become misaligned on the rack, resulting in damage to the bikes and/or the vehicle.

SUMMARY

The present invention provides a rack assembly for carrying bicycles on a vehicle. The assembly includes at least one mount attachable to the vehicle, and a load-carrying support member coupled to the mount and configured to support the bicycle adjacent the vehicle. In one embodiment, a stabilizer member is provided to impede swinging of the bicycle. In another embodiment, a securing apparatus is provided to secure the bicycle to the support member. The securing apparatus includes a strap, adapted to extend at least partially around the bicycle, and at least one of a ratchet mechanism or a drive actuator. The ratchet mechanism is adapted to receive and grip one end of the strap. The drive actuator is operable to grip the strap and draw it tight around the bicycle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of an exemplary embodiment of a rack assembly according to the present invention.

FIG. **2** is an isometric view showing a securing apparatus and portion of a support mount according to the present invention. The drive actuator is shown pivoted upward to advance the strap into the housing.

FIG. **3** is an exploded isometric view of the securing apparatus of FIG. **2**, with a portion of the strap cut away.

FIG. **4** is a front elevation and partial cross-sectional view showing a securing apparatus attached to a support member and arranged to secure a bicycle tire to the support member. The actuator arm is shown in a nominal, released position.

FIG. **5** is similar to FIG. **4** but shows the actuator arm pivoted upward to drive the strap through the housing.

FIG. **6** is similar to FIG. **5** but shows the actuator arm pivoting downward to return to its nominal position.

FIG. **7** is similar to FIG. **4** but shows the actuator arm pivoting downward past its nominal position to disengage the locking member from the strap.

FIG. **8** is an isometric view of another exemplary embodiment of the invention in which the securing apparatus is integrally formed with the supporting member.

FIG. **9** is an isometric view of another exemplary embodiment of the invention in which two ratchet drive mechanisms are formed on either side of a support member to receive opposite ends of a reversible strap.

FIG. **10** is a perspective view of another exemplary embodiment of the invention.

FIG. **11** is a magnified, cross-sectional view showing a bicycle top tube strapped into the cradle member of FIG. **10**. The cross-section is taken along a plane between the outer edge of the strap and the strap cover.

FIG. **12** is a fragmentary perspective and exploded view showing the connection of the stabilizer member to the cradle member of FIG. **10**. The connection of the strap to the cradle member is also shown.

FIG. **13** is a rear elevation showing the top tube of a bicycle received in the cradle member, and the stabilizer member pivoted counter-clockwise to grip the seat tube.

FIG. **14** is similar to FIG. **13** except that the bicycle is slid to the right in the cradle member, and the stabilizer member is pivoted clockwise to grip the down tube.

DETAILED DESCRIPTION

A rack assembly for carrying recreational equipment on a vehicle according to the present invention is indicated generally at **10** in FIG. **1**. Rack assembly **10** includes one or more mounts **12** attachable to a vehicle. Rack assembly **10** also includes one or more support members **14** coupled to mounts **12** and adapted to support recreational equipment adjacent a vehicle. At least one securing apparatus **16** is associated with each support member **14** to secure recreational equipment to the support member.

In the exemplary embodiment depicted in FIG. **1**, rack assembly **10** is shown mounted on the roof of a vehicle **100**, and having a wheel support member **14** adapted to support the wheel of a bicycle **102**. Alternatively, rack assembly **10** may be configured to mount at other positions on a vehicle such as the rear or trunk of the vehicle, on a vehicle hitch, etc. In addition, rack assembly **10** may include support members that are adapted to carry recreational equipment other than bicycles such as canoes, kayaks, surfboards, camping equipment, etc. Therefore, while the invention is described below in the context of securing a bicycle to a rack mounted on the roof of a vehicle, it will be understood that all such vehicle racks and support members are included within the scope of the invention.

Turning attention to FIGS. **2** and **3**, securing apparatus **16** is shown in greater detail. The securing apparatus includes a housing **18**, and a strap **20** having a near end **22** and a far

end **24**. In the exemplary embodiment, near end **22** is integrally formed with housing **18** from a single material. Alternatively, strap **20** and housing **18** may be formed separately and connected by any suitable means such as rivets, bolts, etc. In any event, far end **24** is adapted to extend around at least a portion of the recreational equipment and be received into housing **18**.

Securing apparatus **16** is movably coupled to support member **14** to allow the strap to be selectively positioned on the support member. The securing apparatus includes a tongue **26** adapted to slidably engage a channel **28** in support member **14**. Alternatively, securing apparatus **16** may be movably coupled to support member by other suitable mechanisms, or may be rigidly attached to the support member by a bolt, rivet, etc. As a further alternative, the securing member may not be attached to the support member, but instead may encircle the support member and recreational equipment to hold the equipment securely against the support member.

Securing apparatus **16** also includes a locking member **30** coupled to housing **18** and configured to engage the strap and retain it in the housing. Locking member **30** is configured to allow the strap to be inserted into the housing while preventing the strap from being removed from the housing. In the exemplary embodiment, the locking member is pivotally coupled to the housing by a rivet pin **32** which extends through holes **34** in the housing and hole **36** in the locking member. A spring **38** biases a back end **40** of the locking member toward the housing.

The securing apparatus further includes a drive actuator or lever **42** coupled to housing **18** and operable to grip the strap and advance it through the housing to tighten the strap around the recreational equipment. In the exemplary embodiment, drive actuator **42** is pivotally coupled to housing **18** by a rivet pin **44** that passes through holes **46** in the housing and holes **48** in the drive actuator. A spring **50** biases the drive actuator downward over locking member **30**. A pair of ribs **52** are formed on the underside of the drive actuator and abut against a front end **54** of the locking member.

The operation of securing apparatus **16** is illustrated in FIGS. **4–7**. Apparatus **16** is shown movably coupled to a support member **14**, which is adapted to support a wheel **104** of a bicycle. Strap **20** extends around wheel **104** and is received into housing **18**. A plurality of grip elements or teeth **58** extend laterally across the strap. The strap passes between drive actuator **42** and locking member **30** on one side and the bottom wall of housing **18** on the other side. Teeth **58** face toward the drive actuator and locking member so that the strap can slide along the bottom wall of the housing. As best seen in FIGS. **2** and **3**, teeth **58** extend across the strap between smooth edge regions **60**. The strap passes into the housing and under opposing guide rails **62** projecting from either side of the housing. The guide rails slide over edge regions **60** and hold the strap against the bottom wall of the housing.

In the exemplary embodiment, locking member **30** functions as a ratchet. Referring back to FIGS. **4–7**, the underside of locking member **30** includes a pawl structure such as one or more teeth **64**, configured to engage teeth **58** on the strap. Teeth **64** are disposed adjacent back end **40** and interlock with teeth **58** when the back end is pivoted toward the strap, as seen in FIG. **4**. Teeth **58** on the strap and teeth **64** on the locking member are formed with an incline such that the locking member only grips the strap in one direction. When the strap is pulled in a forward direction through the housing, locking member **30** pivots upward to allow the strap to pass, as shown in FIG. **5**. However, when the strap is pulled backward out of the housing, teeth **64** interlock with teeth **58** and block movement of the strap to retain it in the housing, as shown in FIG. **4**.

Drive actuator **42** also includes one or more teeth **66** configured to engage teeth **58** on the strap. When the drive actuator is pivoted upward, teeth **66** interlock with, and engage teeth **58** to drive the strap through the housing, as shown in FIG. **5**. As the drive actuator advances the strap through the housing, locking member **30** grips the strap and prevents it from pulling back out of the housing. As shown in FIG. **6**, the drive actuator is then pivoted downward, under the bias of spring **50**, into position to grip the next successive portion of the strap. Hole **46** in housing **18** is oblong, allowing pin **44** and drive actuator **42** to slide away from the strap. This enables teeth **66** to slide over teeth **58** on the downward stroke of drive actuator **42**.

In addition to driving strap **20** into housing **18**, exemplary drive actuator **42** also is operable to disengage locking member **30** from the strap. As mentioned above, ribs **52** abut against the front end of the locking member when the drive actuator is released. Although the bias imparted to the drive actuator by spring **50** causes the ribs to apply a downward force on the front end of the locking member, the upward bias on the front end of the locking member due to spring **38** is sufficient to support the downward force applied by the ribs. However, a user may overcome the bias of spring **38** by pressing the drive actuator downward against the front end of the locking member. As shown in FIG. **7**, this causes pin **44** and drive actuator **42** to slide backward in oblong hole **46** to a position more directly over the front end of the locking member. Continued downward movement by the drive actuator causes the back end of the locking member to pivot away from the strap, thereby disengaging teeth **64** from teeth **58** and allowing the strap to be removed from the housing.

Together, housing **18**, locking member **30** and drive actuator **42** form a ratchet drive mechanism **68** adapted to receive the far end of strap **20** and tighten it around the recreational equipment. To operate the ratchet drive mechanism, the user positions the strap around the recreational equipment and inserts the far end of the strap into the housing until the strap is gripped by locking member **30**. The user then repeatedly pivots drive actuator **42** up and down to grip successive portions of the strap and draw it tight. The drive actuator functions as a lever to magnify the force applied by the user. To release the strap, the user pivots the drive actuator downward into the locking member to disengage the locking member from the strap.

It will be appreciated that the drive mechanism may be operably formed in alternative configurations to those shown in the exemplary embodiments. As one example, drive actuator **42** may be in the form of a knob attached to a circular gear that engages the strap as the knob is rotated. Alternatively, mechanism **56** may omit drive actuator **42** and the strap may be advanced through the housing by other means (e.g., pushing or pulling the strap through the housing, etc.). As another alternative, mechanism **56** may omit the locking member and the housing may grip the strap by other means (e.g., frictionally, etc.).

The various components of securing apparatus **16** may be formed of any single material or combination of materials including metal, plastic, etc. In the embodiment where housing **18** and strap **20** are integrally formed of a single material, one suitable material is a rigid plastic such as injection-molded nylon. Locking member **30** and drive actuator **42** may also be formed of injection-molded nylon.

Typically, though not necessarily, springs **38** and **50**, and pins **32** and **44** are formed of metal.

FIG. **8** illustrates another embodiment where at least a portion of securing apparatus **16** is integrally formed with support member **14** from a single material. Near end **22** of strap **20** is formed with one side of the support member, while housing **18** is formed with the opposite side of the support member. This embodiment ensures that the securing apparatus does not become dislodged or lost. Alternatively, either or both of strap **20** and housing **18** may be formed separately and then either permanently or removably attached to the support member by bolts, rivets, adhesive, snap-on connectors, etc.

FIG. **9** illustrates another embodiment where securing apparatus **16** includes plural ratchet drive mechanisms **68**. The housings of the ratchet drive mechanisms are integrally formed with opposite sides of support member **14**. Alternatively, one or both housings may be formed separately and attached to the support member by bolts, rivets, adhesive, etc. Strap **20** is formed separately with symmetrical ends **70**. The ends include teeth **58** formed with opposing inclines adapted to be received by the opposing ratchet drive mechanisms. The embodiment shown in FIG. **9** allows the user to tighten the strap from either side of the support member. Thus, the support member and securing apparatus can be mounted on either side of a vehicle for similar ease of use.

FIGS. **10** and **11** illustrate another embodiment of the invention which is shown configured for use on vehicles with rear hitch-mounts, such as standard 2-inch by 2-inch or 1¼-inch by 1¼-inch receiver hitches. In this embodiment, rack assembly **10** includes a rack **200** mountable on a rear hitch-mount to carry one or more bicycles adjacent the rear of a vehicle. Rack **200** includes a hitch coupling member **202** adapted to securely attach to a rear hitch-mount. Coupling member **202** may be any of a variety of hitch couplings which are well known in the art. In addition, coupling member **202** may include one or more holes, slots, etc., (not shown) for receiving attachment devices such as bolts, pins, etc., which are associated with the vehicle receiver hitch. A single elongate, generally upright mast **204** extends upward from coupling member **202** adjacent the rear of the vehicle. In some embodiments, coupling member **202** and/or mast **204** may be pivotal to swing away from the rear of the vehicle to allow access to a rear door or trunk of the vehicle.

At least one support arm **206** extends outward or rearward from the upper end of mast **204**. The support arm is typically rigidly connected to the mast to support the weight of one or more bicycles. In the exemplary embodiment depicted in FIG. **10**, the support arm is integrally formed with the mast. Rack **200** is typically formed of a rigid material such as metal or plastic.

Rack assembly **10** also includes at least one load-carrying support member **208** associated with rack **200** to receive and retain the top tube **106** of a bicycle. In the exemplary embodiment, support member **208** is in the form of a cradle adapted to receive and at least partially surround the top tube. Cradle **208** includes a body **210** having a central bore **212** adapted to receive and grip support arm **206** to prevent the cradle from rotating about the support arm. Typically, the central bore is selectively contractible to clamp onto the support arm. In the exemplary embodiment illustrated in FIG. **11**, a channel **214** passes from an outer portion of the cradle to the central bore. A screw (not shown) passes through body **210** and across the channel. When the screw is tightened, the width of the channel shrinks and the central bore contracts, thereby clamping onto the support arm. Cradle member **208** is adapted to slide axially along the support arm until clamped in place. A plurality of cradle members may be slid onto the support arm to carry a plurality of bicycles.

Typically, the support arm and cradle have matching non-circular lateral cross-sections. This allows the cradle member to slide along the support arm while preventing it from rotating about the support arm. In the exemplary embodiment, the lateral cross-section of the support arm is rectilinear. The lateral cross-section of central bore **214** is also rectilinear and sized to fit closely over the support arm. It will be appreciated that the lateral cross-sections of the support arm and central bore may be any desired non-circular shape, including oval, etc.

The body **210** of cradle member **208** includes a pair of opposing wing regions **216** extending laterally from central bore **212** to positions adjacent opposite sides of the support arm. The spaced-apart wing regions support and balance corresponding laterally-spaced portions of the bicycle top tube. The wing regions are spaced to fit between the upper portions of a bicycle down tube **108** and seat tube **110**. Preferably, the bicycle is positioned so that the center-of-mass of the bicycle is between the opposing wing regions. (See FIGS. **13** and **14**) This ensures the top tube will lie flat against the cradle member. Alternatively or additionally, the top tube may be secured to the cradle member to hold the top tube against both wing regions, as described in more detail below.

Each wing region includes one or more opposing shoulders **218** extending generally upward adjacent forward and rear edges of body **210**. When the top tube of a bicycle is received on the cradle member between opposing shoulders, the shoulders prevent the top tube from becoming dislodged either forwardly or rearwardly from the cradle. Shoulders **218** may be angled outward to facilitate alignment of the top tube between the shoulders. Cradle member **208** is typically formed of a relatively rigid, light-weight material which is suitable for supporting the weight of a bicycle. In the exemplary embodiment, the cradle member is formed of 14% glass filled nylon. Alternatively, other materials may be used such as different plastics, aluminum, steel, etc.

A resilient covering **220** may be attached to the cradle member to cushion the top tube. Covering **220** may be formed of any suitable material such as an elastomer, etc. In the exemplary embodiment, covering **220** also extends over shoulders **218** to form a cushioned trough adapted to receive the top tube of a bicycle.

In one embodiment, rack assembly **10** also includes a securing system including at least one securing mechanism **222** adapted to retain the top tube in the cradle member. As shown in FIGS. **10–12**, securing mechanism **222** includes a strap **224**, which is positionable over the top tube and receivable in a housing **226**. Ratchet **228** is coupled to the housing to engage the strap and prevent the strap from being removed from the housing. Drive actuator **230** is coupled to the housing and operable to grip the strap and advance it through the housing. The drive actuator may also be operable to disengage the ratchet to allow removal of the strap from the housing. In alternative embodiments, either ratchet **228** or drive actuator **230** may be omitted. As the securing mechanism has been described in detail above, that description will not be repeated here. It should be understood, however, that the securing mechanism may also take alternative forms including a flexible strap (such as described below), a clamp, a latch, a bracket, or any other device suitable for holding the top tube against the cradle member.

Rack assembly **10** may include a plurality of securing mechanisms associated with each cradle. For example, in the exemplary embodiment shown in FIGS. **10**, **13**, and **14**, a securing mechanism is positioned adjacent each wing region **216**. This arrangement ensures the top tube is held against both wing regions, thereby preventing the bike from rocking or lifting off one of the wing regions. Alternatively, the securing system may comprise a single securing mechanism located between the wing regions, which would also function to hold the top tube against both spaced-apart wing regions of the cradle member.

Housing **226** may be integrally formed with cradle member **208**, as depicted in the exemplary embodiment. Alternatively, the housing may be formed separately and attached to the cradle by any suitable means. Similarly, strap **224** may be integrally formed with the cradle member or formed separately. As illustrated in FIGS. **11** and **12**, strap **224** of the exemplary embodiment is formed separately from a substantially flexible material such as flexible polyester. The strap is coupled to the cradle member opposite housing **226**. Cradle member **208** includes mount **232** which protrudes from body **210**. Mount **232** defines a socket **234** and a slot **236**. The slot is configured to receive strap **224**. The rear end of the strap is attached to an anchor **238**. The anchor is adapted to be received in socket **234** and is retained therein in response to tension on the strap because the anchor is dimensioned so that it cannot pass through slot **236**. Thus, the strap is coupled to the cradle member by passing the strap through slot **236** until anchor **238** is received in socket **234**. An inclined ridge or tab **240** on the strap prevents accidental removal of the strap from slot **236**. Preferably, tab **240** can be passed backward through slot **236** with moderate force. While one example of a removable coupling between the strap and the cradle member has been shown and described, it will be appreciated that any type of coupling may be used within the scope of the invention. For example, the strap may be coupled to the cradle member by a bolt, etc. As another example, the strap may be coupled to housing **226**, or the vehicle, or the bicycle, etc.

In the depicted embodiment of securing mechanism **222**, a protective cover **242** is connected to the strap, to cushion the top tube from the strap; see FIGS. **10** and **11**. Cover **242** is typically formed of a relatively resilient material such as an elastomer. The cover is connected to the strap so that the cover is interposed between the strap and the top tube when the strap is tightened. In the exemplary embodiment, cover **242** is in the form of a sleeve which defines an aperture **244** adapted to slidably receive the strap. As shown in FIG. **12**, where cover **242** is not depicted in order to reveal underlying structure, one or more protruding regions **246** on the strap function to retain cover **242** on the strap. Typically, the strap is selectively expandable to slide over protruding regions **246**.

Optionally, protective cover **242** may define one or more grooves **248** extending perpendicular to the elongate axis of the strap. As is well known to those of skill in the art, bicycles often have one or more control cables **112** (e.g., brake cable, gear cable, etc.) extending along the top tube. Grooves **248** are adapted to receive and fit around cables **112** when the strap is tightened over the top tube. As a result, cables **112** are not pinched between the strap and the tube. Since cable **112** may be placed at various positions about top tube **106**, protective cover **242** typically is sized to allow it to slide between protruding regions **246** and mount **232** to align a groove with the cable.

In the depicted embodiment of the invention, rack assembly **10** includes a stabilizer member **250** adapted to grip a portion of the bicycle frame and impede swinging of the bicycle in cradle member **208**. Stabilizer member **250** is associated with support arm **206**, and movable to selectively grip either the down tube or the seat tube of a bicycle held in cradle member **208**. Depending on the size and configuration of the bicycle frame, it may be necessary to slide the bicycle laterally in the cradle member to position stabilizer member **250** in contact with a selected portion of the bicycle frame. Together, cradle member **208** and stabilizer member **250** form an assembly adapted to hold the bicycle adjacent the rear of the vehicle.

In the exemplary embodiment depicted in FIGS. **10** and **12-14** stabilizer member **250** includes an elongate pivot arm **252** with a near end **254** adjacent support arm **206**, and a far end **256** spaced apart from the support arm. A gripping member **258** is disposed adjacent far end **256** to contact and grip a portion of the bicycle frame. The stabilizer member also includes one or more collars **260** disposed adjacent near end **254**. In the exemplary embodiment, pivot arm **252** is in the form of a fork assembly with two spaced-apart collars disposed adjacent near end **254**.

Collars **260** have a circular inner surface and are adapted to fit over and rotate around support arm **206**. In the embodiment of the invention where support arm **206** has a rectilinear (or otherwise non-circular) lateral cross-section, stabilizer member **250** also includes a bushing **262** associated with each collar. The bushing has a circular outer surface which is rotatably receivable in the collar. Bushing **262** also has a rectilinear (or otherwise non-circular) central bore **264** adapted to receive the support arm and prevent rotation of the bushing about the support arm. The combination of collars **260** and bushings **262** form a pivot assembly adapted to securely and pivotally couple stabilizer member **250** to the support arm even though the support arm has a non-circular cross-section. It should be noted that the bushing arrangement could also be used on non-circular cross bars on roof-mounted rack or other non-circular support members to pivotally couple another member of a rack to the support member.

The two halves of pivot arm **250** are sized to fit around the cradle member. As a result, the cradle member may be mounted on the support arm between spaced-apart collars **260**. This serves to ensure the stabilizer member is aligned with a bicycle received in the cradle. A pair of slots **266** is formed in the upper portion of central bore **212**. Each bushing **262** includes an inwardly projecting tongue **268** adapted to engage one of slots **266** and align the stabilizer member with the cradle member for mounting onto the support arm. Tongues **268** also grip the edges of slots **266** to prevent bushings **262** from sliding along the support arm away from the cradle member. In alternative arrangements, the stabilizer member may be mounted forward or rearward of the cradle member.

In the embodiment described above, stabilizer member **150** is mounted on the support member and pivots about a pivot axis A which coincides with the elongate central axis of the support member. It will be appreciated that other arrangements are also possible within the scope of the invention. For example, collars **260** may be rotatably coupled to the cradle member. As a further example, the collars may be rotatably coupled to some intermediate structure mounted on the support arm. In which case, pivot axis A would not be coincident with the central axis of the support member. In another example, stabilizer member **250** may be mounted on the support arm and cradle member **208** may be coupled to the stabilizer member. In any event, stabilizer member **250** is selectively movable in one direc-

tion to engage the down tube, and in an opposite direction to engage the seat tube. Thus, the stabilizer member can be moved to engage either the down tube or the seat tube regardless of which direction the bicycle is facing. Where plural bicycles are mounted on the support arm, the bicycles can be oriented facing in alternating directions so that less space is required between the bicycles.

Since the down tubes and seat tubes of different bicycles form different angles with respect to the top tube, gripping member **258** is typically shaped to present a uniform gripping surface when pivoted in either direction. As best seen in FIG. **10**, gripping member **258** defines a central axis B which is parallel to pivot axis A and perpendicular to the pivot direction of the stabilizer member. Gripping surface **270** is substantially symmetric about central axis B. As a result, gripping member **258** presents a uniform gripping surface in all directions.

Gripping member **258** may have any uniform gripping surface **270** as desired for a particular application. In the exemplary embodiment, the gripping member has a gripping surface which is generally spool or hourglass shaped. In other words, gripping surface **270** is circumferentially concave, thereby presenting a concave gripping surface whether viewed along one pivot direction or along the opposite pivot direction. The concave gripping surface is adapted to receive and at least partially surround a portion of the bicycle frame such as down tube **108** or seat tube **110**.

It will be appreciated that gripping member **258** may take any one of many symmetric forms configured to present a uniform gripping surface. Therefore, while one particular form has been illustrated and described, the invention is not limited to that particular form. Alternatively, the gripping member may be configured to present non-uniform gripping surfaces. For example, the gripping member may include one gripping surface adapted to grip a portion of the bicycle wheel, and a different gripping surface adapted to grip a portion of the bicycle frame.

Preferably, the bicycle frame is gripped by gripping member **258** at a point which is not co-linear with the top tube. For example, in FIGS. **13** and **14**, the stabilizer member grips the frame at points below the top tube. This increases the amount of torque that stabilizer member **250** can apply to the frame to impede swinging of the bicycle. Alternatively, stabilizer member **250** may be configured to grip a portion of the bicycle above top tube **106**.

Stabilizer member **250** may also include a strap **272** configured to retain the bicycle frame within the gripping member. In the exemplary embodiment, strap **272** is formed from an elastic material (e.g. Dynaflex G7431 rubber), and has a plurality of holes **274**. Gripping member **258** includes anchor posts **276** adapted to fit within holes **274**. Thus, the strap is employed to retain the bicycle frame in the gripping member by placing one of holes **274** over an anchor post, wrapping the strap around the bicycle frame, and placing another of the holes over the opposite anchor post.

The gripping member may be constructed of any suitable material, including an elastomer. The gripping member is connected to far end **256** of the pivot arm by a pin or bolt **278**, which passes through both the gripping member and the pivot arm. In some embodiments, gripping surface **270** may be configured to rotate about central axis B to reduce rubbing between the gripping surface and the bicycle frame.

The embodiment of rack assembly **10** shown in FIGS. **10–14** includes cradle member **208**, dual securing mechanisms **222**, and stabilizer member **250**. The securing mechanisms are disposed on opposite sides of the support arm. Thus, the bicycle is strapped at three locations, two spaced-apart locations along the top tube and a third location on either the down tube or the seat tube. This provides a very stable and secure arrangement for carrying the bicycle during travel because the bicycle is restrained from swinging, sliding, rotating or otherwise moving relative to the rack. Alternatively, the bicycle may be strapped at more locations or fewer locations. It will be understood that while the bike frame is described as being "strapped" to the rack, other means of securement may be used in place of one or more of the straps.

In another embodiment of rack assembly **10**, the securing mechanism and cradle member may be omitted. Alternatively, the stabilizer member and/or the securing mechanism may be omitted. In any case, each embodiment of rack assembly **10** provides a flexible and secure apparatus for carrying a bicycle adjacent the rear of a vehicle.

It is believed that the disclosure set forth above encompasses multiple distinct inventions with independent utility. While each of these inventions has been disclosed in its preferred form, the specific embodiments thereof as disclosed and illustrated herein are not to be considered in a limiting sense as numerous variations are possible. The subject matter of the inventions includes all novel and non-obvious combinations and subcombinations of the various elements, features, functions and/or properties disclosed herein. No single feature, function, element or property of the disclosed embodiments is essential to every one of the disclosed inventions. Similarly, where the claims recite "a" or "a first" element or the equivalent thereof, such claims should be understood to include incorporation of one or more such elements, neither requiring nor excluding two or more such elements.

It is believed that the following claims particularly point out certain combinations and subcombinations that are directed to some of the disclosed inventions and are novel and non-obvious. Inventions embodied in other combinations and subcombinations of features, functions, elements and/or properties may be claimed through amendment of the present claims or presentation of new claims in this or a related application. Such amended or new claims, whether they are directed to a different invention or directed to the same invention, whether different, broader, narrower or equal in scope to the original claims, are also regarded as included within the subject matter of the inventions of the present disclosure.

We claim:

1. Apparatus for carrying a bicycle on a vehicle having a rear hitch-mount, where the bicycle includes a frame having a top tube, a down tube and a seat tube, the apparatus comprising:

a bicycle rack mountable on the vehicle hitch-mount and adapted to support one or more bicycles adjacent the rear of the vehicle during travel, where the rack includes a generally upright mast and at least one support arm extending outwardly from the mast; and

at least one assembly mounted on the at least one support arm to hold a bicycle, including

load-carrying structure adapted to receive and retain a first one of the frame tubes of the bicycle on the support arm, the load-carrying structure including a cradle member, and

a stabilizer member coupled to the load-carrying structure and pivotal about a pivot axis to selectively grip either of the frame tubes of the bicycle other than the first one, while the first one of the frame tubes is

fixedly retained by the load-carrying structure, the stabilizer member including

an elongate pivot arm with a first end portion proximal to the pivot axis and a second end portion distal to the pivot axis, and

a gripping member disposed adjacent the second end portion of the pivot arm.

2. The apparatus of claim **1**, where the load-carrying structure includes a cradle member adapted to receive the top tube of the bicycle.

3. The apparatus of claim **2** further comprising a securing mechanism adapted to retain the top tube in the cradle member, where the securing mechanism includes a strap positionable over the top tube, a housing attached to the cradle member and adapted to receive the strap, and a ratchet coupled to the housing and adapted to engage the strap and prevent removal of the strap from the housing.

4. The apparatus of claim **3**, where the securing mechanism includes a drive actuator coupled to the housing and operable to grip the strap and advance it through the housing to tighten the strap over the top tube. cradle member.

5. The apparatus of claim **4**, where the drive actuator is operable to disengage the ratchet from the strap to allow removal of the strap from the housing.

6. The apparatus of claim **3**, where the housing is integrally formed with the cradle member.

7. The apparatus of claim **1**, where the other frame tubes of the bicycle are the seat tube and the down tube and the stabilizer includes a gripping member that is shaped to present a uniform gripping surface whether pivoted in one direction to grip the down tube, or pivoted in an opposite direction to grip the seat tube.

8. The apparatus of claim **1**, where the stabilizer includes a gripping member having a gripping surface that is concave as viewed along both pivot directions.

9. The apparatus of claim **1**, where the stabilizer member is pivotally mounted on the at least one support arm.

10. The apparatus of claim **9**, where the support arm has a non-circular lateral cross section, and where the stabilizer member includes a pivot assembly adapted to receive, and rotate about, the support arm.

11. The apparatus of claim **10**, where the pivot assembly includes a bushing adapted to fit over the support arm, and a circular collar adapted to rotate about the bushing.

12. Apparatus for securing a bicycle on a vehicle-mounted rack, where the rack includes at least one support arm adapted to support the bicycle, the apparatus comprising:

a stabilizer member coupled to the support arm and selectively pivotal about a pivot axis, where the stabilizer member includes

an elongate pivot arm with a near end adjacent the support arm, and a far end spaced apart from the support arm, and

a gripping member disposed adjacent the far end of the pivot arm, where the gripping member defines symmetric gripping surfaces facing in opposite pivot directions.

13. The apparatus of claim **12**, where the support arm defines a central elongate axis, and where the pivot axis coincides with the central elongate axis of the support arm.

14. The apparatus of claim **12**, where the gripping member defines oppositely concave gripping surfaces.

15. The apparatus of claim **12**, where the gripping member defines a circumferentially concave gripping surface.

16. The apparatus of claim **12**, where the gripping member defines a generally hourglass-shaped gripping surface.

17. The apparatus of claim **12**, where the near end of the pivot arm includes at least one collar adapted to fit over and rotate around the support arm.

18. The apparatus of claim **17**, where the stabilizer member includes a bushing rotatably receivable in the collar and having a rectilinear central bore adapted to receive a support arm having a rectilinear lateral cross-section.

19. The apparatus of claim **18**, where the at least one collar includes two spaced-apart collars adapted to fit over and rotate about the support arm, and further comprising a cradle member mountable on the support arm between the spaced-apart collars, where the cradle member includes a rectilinear central bore adapted to receive and grip the support arm to prevent rotation of the cradle member about the support arm.

20. Apparatus for carrying a bicycle on a vehicle having a rear hitch-mount, where the bicycle includes a frame having a top tube, a down tube and a seat tube, the apparatus comprising:

a bicycle rack mountable on the vehicle hitch-mount and adapted to support a bicycle adjacent the rear of the vehicle during travel; and

at least one assembly mounted on the rack to hold a bicycle, including

a load-carrying member having two spaced-apart regions adapted to support the top tube of the bicycle at two corresponding spaced-apart locations,

a securing system associated with the load-carrying member and adapted to hold the top tube against both spaced-apart regions of the load-carrying member, and

a stabilizer member coupled to the load-carrying member and pivotal about a pivot axis to selectively engage and grip either the down tube or the seat tube, while the top tube is fixedly retained by the load-carrying member, the stabilizer member including

an elongate pivot arm with a first end portion proximal to the pivot axis and a second end portion distal to the pivot axis, and

a gripping member disposed adjacent the second end portion of the pivot arm.

21. The apparatus of claim **20**, where the rack includes a generally upright mast and at least one support arm extending outwardly from the mast, and where the two spaced-apart regions of the load-carrying member are positioned adjacent opposite sides of the at least one support arm.

22. The apparatus of claim **21**, where the securing system includes two straps, and where each strap is coupled to the load-carrying member and positioned adjacent a different one of the two spaced-apart regions.

23. A rack for securing sports equipment to a vehicle, comprising:

at least one elongate support member having a non-circular cross section;

mounting structure adapted to secure the support member to the exterior of a vehicle;

a bushing portion configured to fit around the elongate support member; and

a first member pivotally mounted to the bushing for pivotal movement about the elongate axis of the support member.

24. The rack of claim **23**, wherein the mounting structure is adapted to attach to a hitch receiver tube mounted to the vehicle.

25. The rack of claim **23**, wherein the elongate, support member is generally rectilinear in cross section.

26. The rack of claim **23**, wherein the bushing has a generally circular outer surface and the first member includes a collar adapted to fit over the bushing.

27. Apparatus for carrying a bicycle on a vehicle having a rear hitch-mount, where the bicycle includes a frame having a top tube, a down tube and a seat tube, the apparatus comprising:

a bicycle rack mountable on the vehicle hitch-mount and adapted to support one or more bicycles adjacent the rear of the vehicle during travel, where the rack includes a generally upright mast and at least one support arm extending outwardly from the mast; and

at least one assembly mounted on the at least one support arm to hold a bicycle, including

load-carrying structure including a cradle member adapted to receive the top tube of the bicycle on the support arm,

a securing mechanism adapted to retain the top tube in the cradle member, where the securing mechanism includes a strap positionable over the top tube, a housing attached to the cradle member and adapted to receive the strap, and a ratchet coupled to the housing and adapted to engage the strap and prevent removal of the strap from the housing, and

a stabilizer member coupled to the load-carrying structure and pivotal about a pivot axis to selectively grip either the down tube or the seat tube to impede swinging of the bicycle, the stabilizer member including

an elongate pivot arm with a first end portion proximal to the pivot axis and a second end portion distal to the pivot axis, and

a gripping member disposed adjacent the second end portion of the pivot arm.

28. The apparatus of claim 27, where the securing mechanism includes a drive actuator coupled to the housing and operable to grip the strap and advance it through the housing to tighten the strap over the top tube.

29. The apparatus of claim 28, where the drive actuator is operable to disengage the ratchet from the strap to allow removal of the strap from the housing.

30. The apparatus of claim 27, where the housing is integrally formed with the cradle member.

31. Apparatus for carrying a bicycle on a vehicle having a rear hitch-mount, where the bicycle includes a frame having a top tube, a down tube and a seat tube, the apparatus comprising:

a bicycle rack mountable on the vehicle hitch-mount and adapted to support one or more bicycles adjacent the rear of the vehicle during travel, where the rack includes a generally upright mast and at least one support arm extending outwardly from the mast, the at least one support arm having a non-circular lateral cross section; and

at least one assembly mounted on the at least one support arm to hold a bicycle, including

load-carrying structure including a cradle member adapted to receive and retain a first one of the tubes of the bicycle on the support arm, and

a stabilizer member pivotally mounted on the at least one support arm, adapted to selectively grip either of the frame tubes of the bicycle other than the first one to impede swinging of the bicycle, and including a pivot assembly adapted to receive, and rotate about, the support arm, the stabilizer member including

an elongate pivot arm with a near end adjacent the support arm, and a far end spaced apart from the support arm, and

a gripping member disposed adjacent the far end of the pivot arm.

32. The apparatus of claim 31, where the pivot assembly includes a bushing adapted to fit over the support arm, and a circular collar adapted to rotate about the bushing.

33. Apparatus for carrying a bicycle on a vehicle having a rear hitch-mount, where the bicycle includes a frame having a top tube, a down tube and a seat tube, the apparatus comprising:

a bicycle rack mountable on the vehicle hitch-mount and adapted to support a bicycle adjacent the rear of the vehicle during travel; and

at least one assembly mounted on the rack to hold a bicycle, including

a load-carrying member having two spaced-apart regions adapted to support the top tube of the bicycle at two corresponding spaced-apart locations,

a securing system associated with the load-carrying member, adapted to hold the top tube against both spaced-apart regions of the load-carrying member, and including two straps, each strap being coupled to the load-carrying member and positioned adjacent a different one of the two spaced-apart regions, and

a stabilizer member coupled to the load-carrying member and selectively pivotal about a pivot axis to engage and grip either the down tube or the seat tube, the stabilizer member including

an elongate pivot arm with a first end portion adjacent the pivot axis and a second end portion spaced from the pivot axis, and

a gripping member disposed adjacent the second end portion of the pivot arm.

34. Apparatus for carrying a bicycle on a vehicle having a rear hitch-mount, where the bicycle includes a frame having a top tube, a down tube and a seat tube, the apparatus comprising:

a bicycle rack mountable on the vehicle hitch-mount and adapted to support one or more bicycles adjacent the rear of the vehicle during travel, where the rack includes a generally upright mast and at least one support arm extending outwardly from the mast; and at least one assembly mounted on the at least one support arm to hold a bicycle, including

a load-carrying member having two spaced-apart regions adapted to support the top tube of the bicycle at two corresponding spaced-apart locations, and

a stabilizer member coupled to the load-carrying member and selectively pivotal about a pivot axis positioned generally between the two spaced-apart regions of the load-carrying member, to grip either of the frame tubes of the bicycle other than the first one to impede swinging of the bicycle, the stabilizer member including

an elongate pivot arm with a first end portion proximal to the pivot axis and a second end portion distal to the pivot axis, and

a gripping member disposed adjacent the second end portion of the pivot arm.

35. The apparatus of claim 34, where the at least one support arm defines a central elongate axis, and the pivot axis coincides with the central elongate axis of the support arm.

36. The apparatus of claim 34, where the gripping member defines oppositely concave gripping surfaces.

37. The apparatus of claim 34, where the gripping member defines a circumferentially concave gripping surface.

38. The apparatus of claim 34, where the gripping member defines a generally hourglass-shaped gripping surface.

39. The apparatus of claim 34, where the near end of the pivot arm includes at least one collar adapted to fit over and rotate around the at least one support arm.

* * * * *

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(12) **United States Patent**
Robins et al.

(10) **Patent No.: US 6,467,664 B2**
(45) **Date of Patent: Oct. 22, 2002**

(54) **BICYCLE CARRIER**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 16 days.

(21) Appl. No.: **09/951,484**

(22) Filed: **Sep. 10, 2001**

(65) **Prior Publication Data**

US 2002/0038810 A1 Apr. 4, 2002

Related U.S. Application Data

(63) Continuation of application No. 09/466,233, filed on Dec. 17, 1999, now Pat. No. 6,286,738.

(51) **Int. Cl.**[7] **B60R 9/00**

(52) **U.S. Cl.** **224/537**; 224/553; 224/532; 224/924

(58) **Field of Search** 224/924, 488, 224/492, 493, 497, 502, 505, 506, 507, 531, 532, 534, 537, 553, 314; 248/292.12, 292.13

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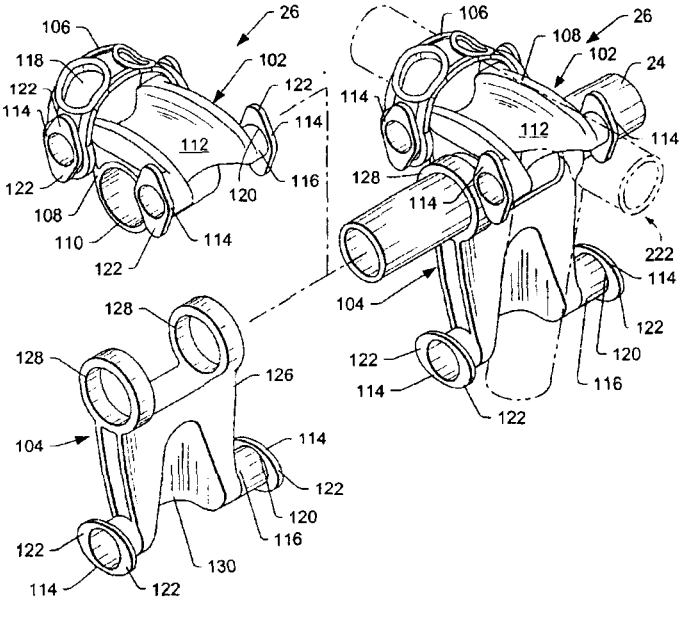
Primary Examiner—Gregory M. Vidovich

(57) **ABSTRACT**

A bicycle rack for carrying a bicycle adjacent the rear of a vehicle. The bicycle rack includes an adjustable frame assembly having a first frame member attached to a housing and a second frame member attached to a connecting member. The connecting member is rotationally coupled to the housing to allow relative pivotal movement between the first and second frame members. A locking member is disposed within the housing and selectively movable between a first position, in which the locking member engages the connecting member to impede relative rotational movement between the connecting member and the housing, and a second position, in which the locking member is disengaged from the connecting member to allow relative rotational movement between the connecting member and the housing. At least one support arm is coupled to the housing and configured for sliding and pivotal movement between a stowed position and an extended position in which the arm engages the housing to support a bicycle adjacent the vehicle. A mounting assembly is positionable on the support arm to hold the bicycle in place during travel.

17 Claims, 7 Drawing Sheets



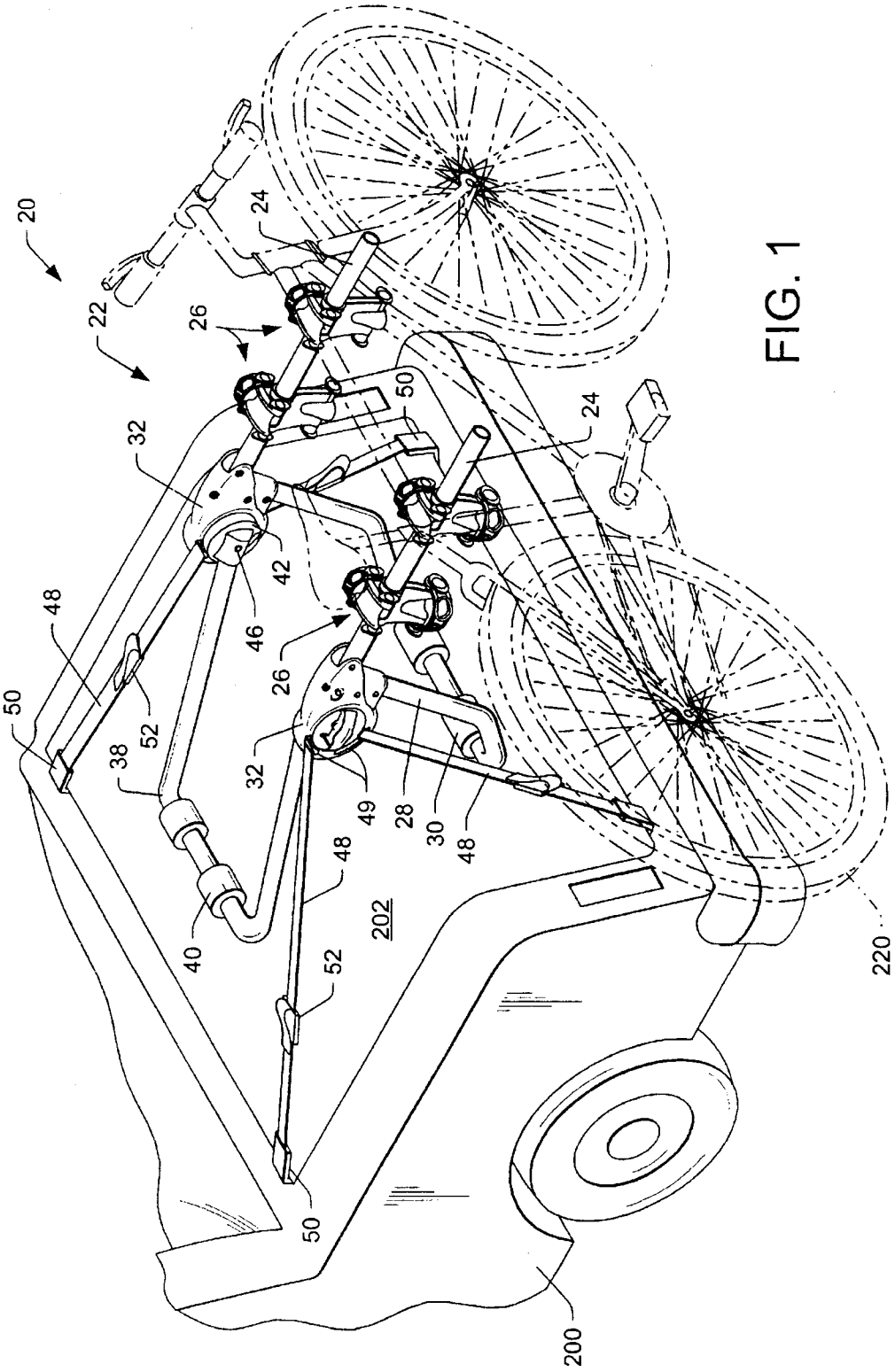


FIG. 1

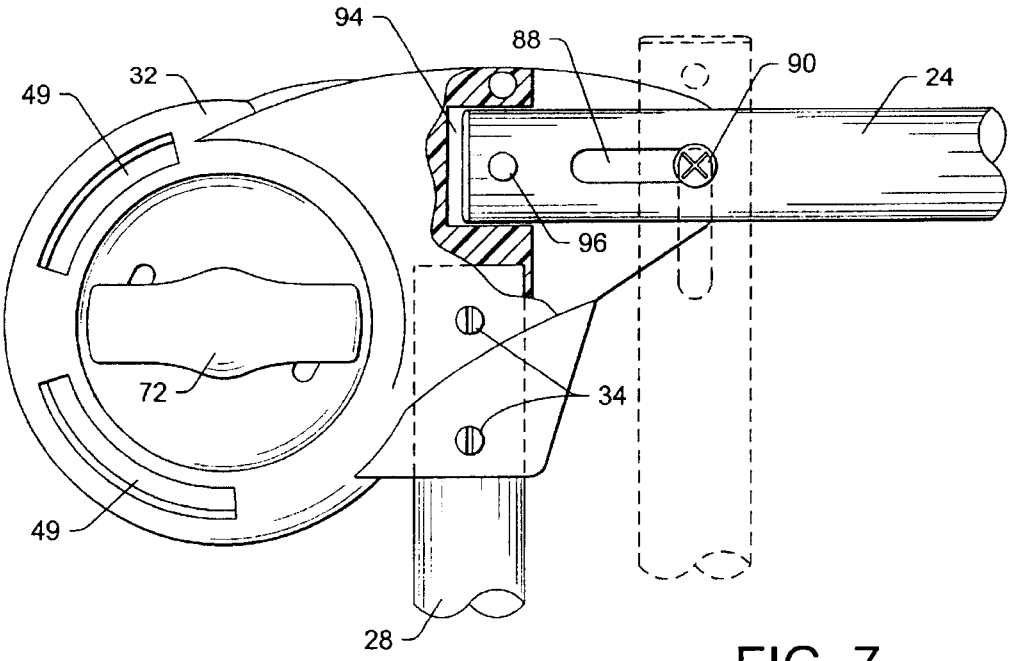

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FIG. 7

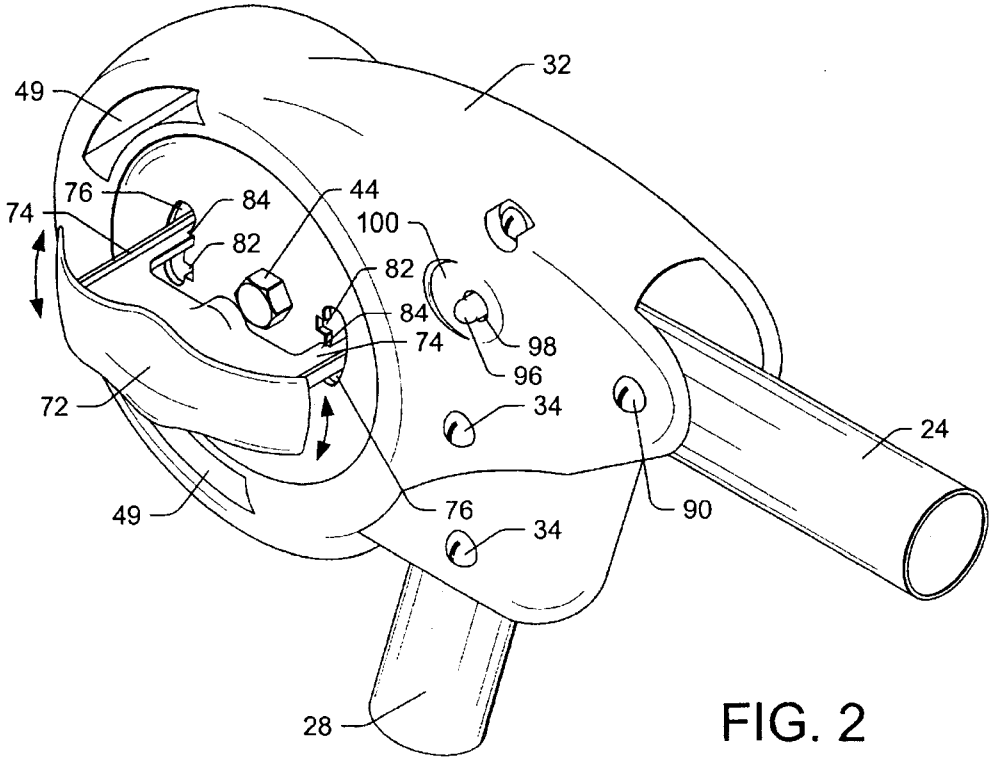
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FIG. 2

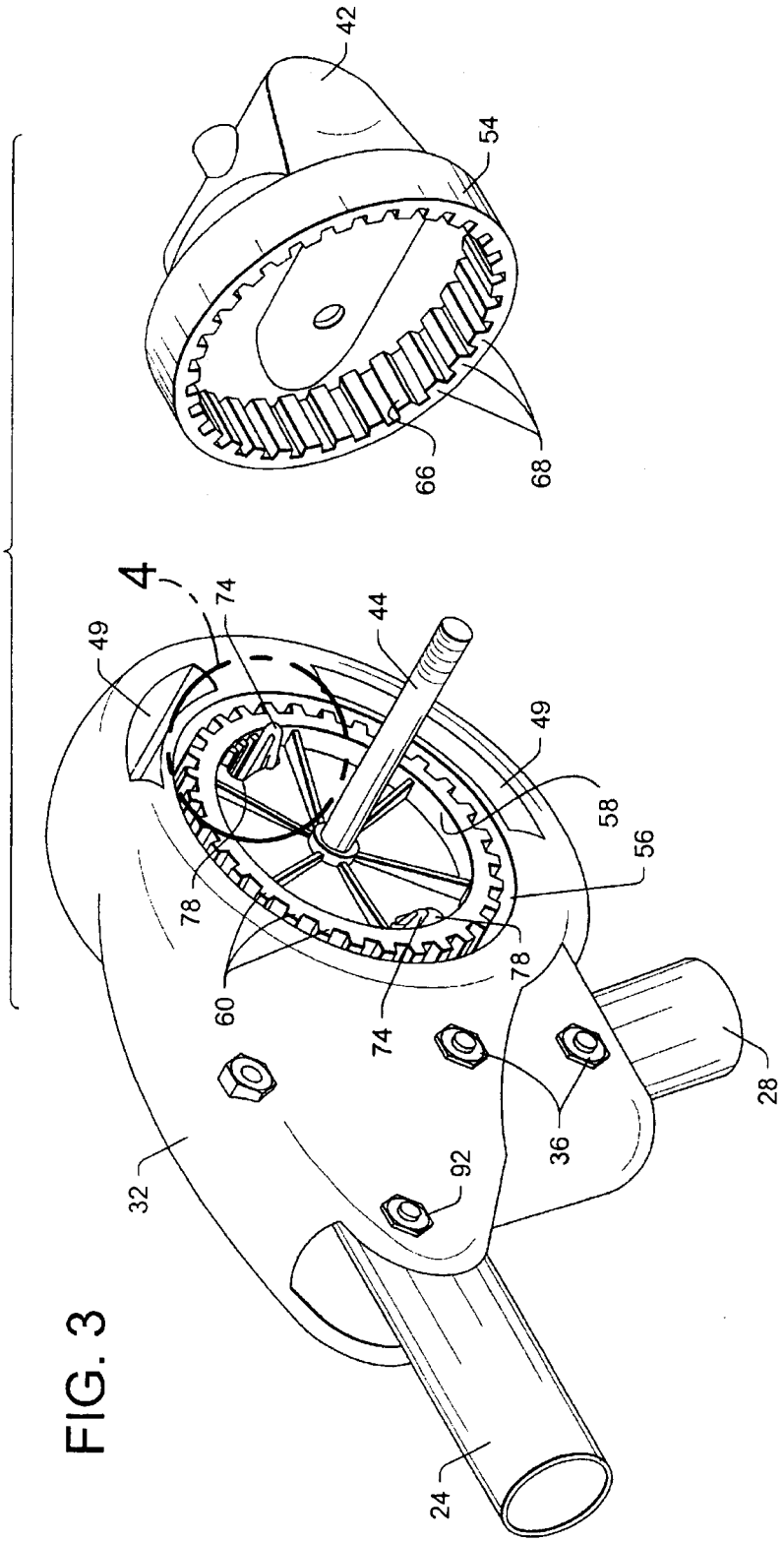
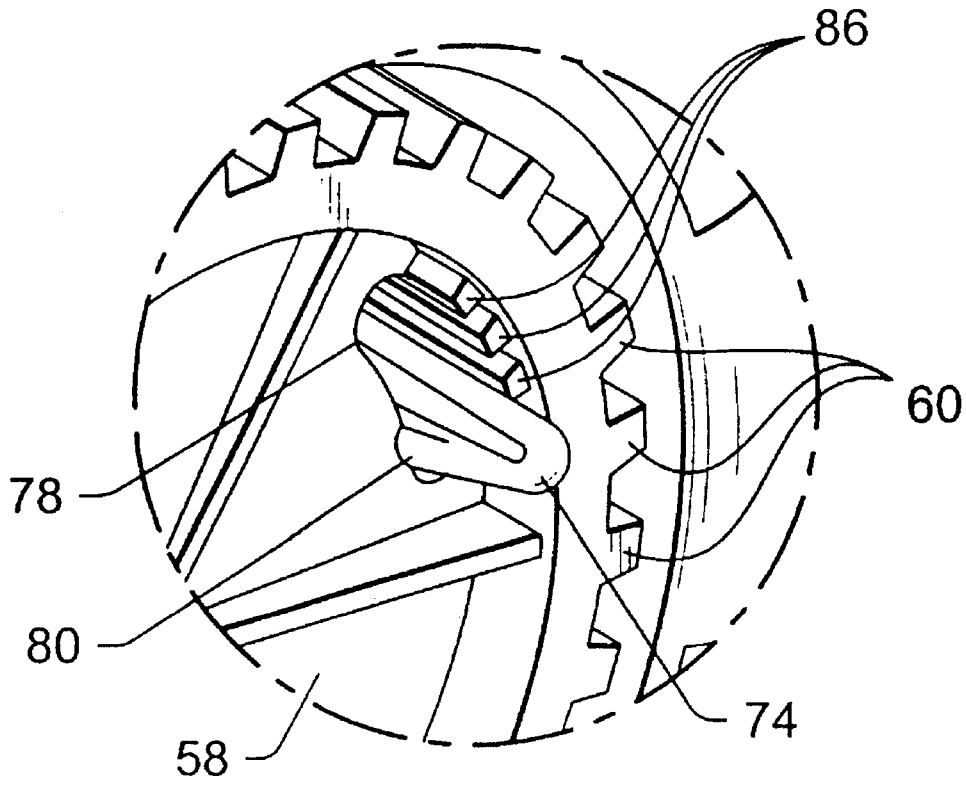


FIG. 3

FIG. 4



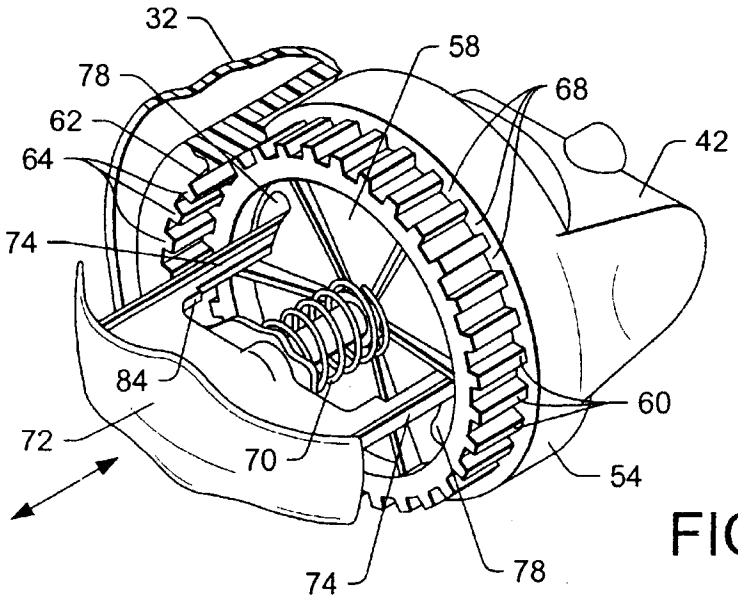

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FIG. 5

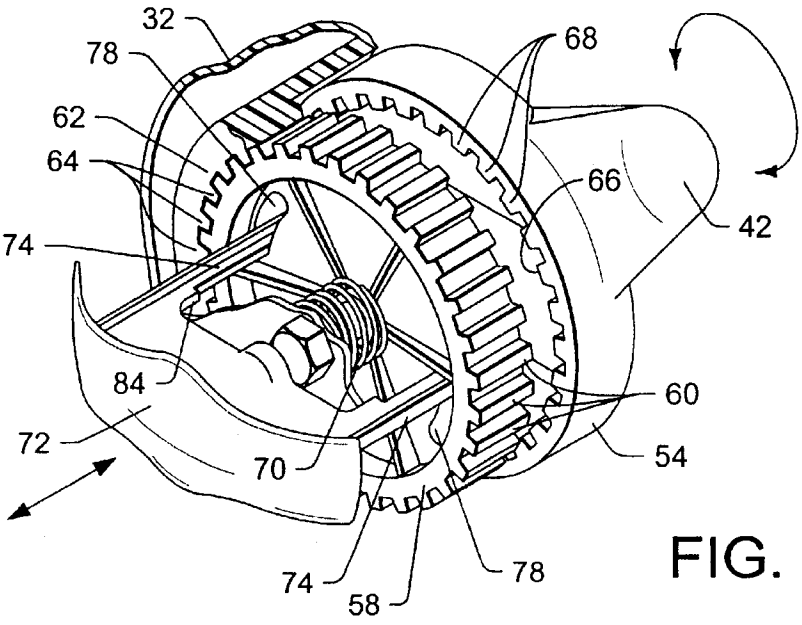
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FIG. 6

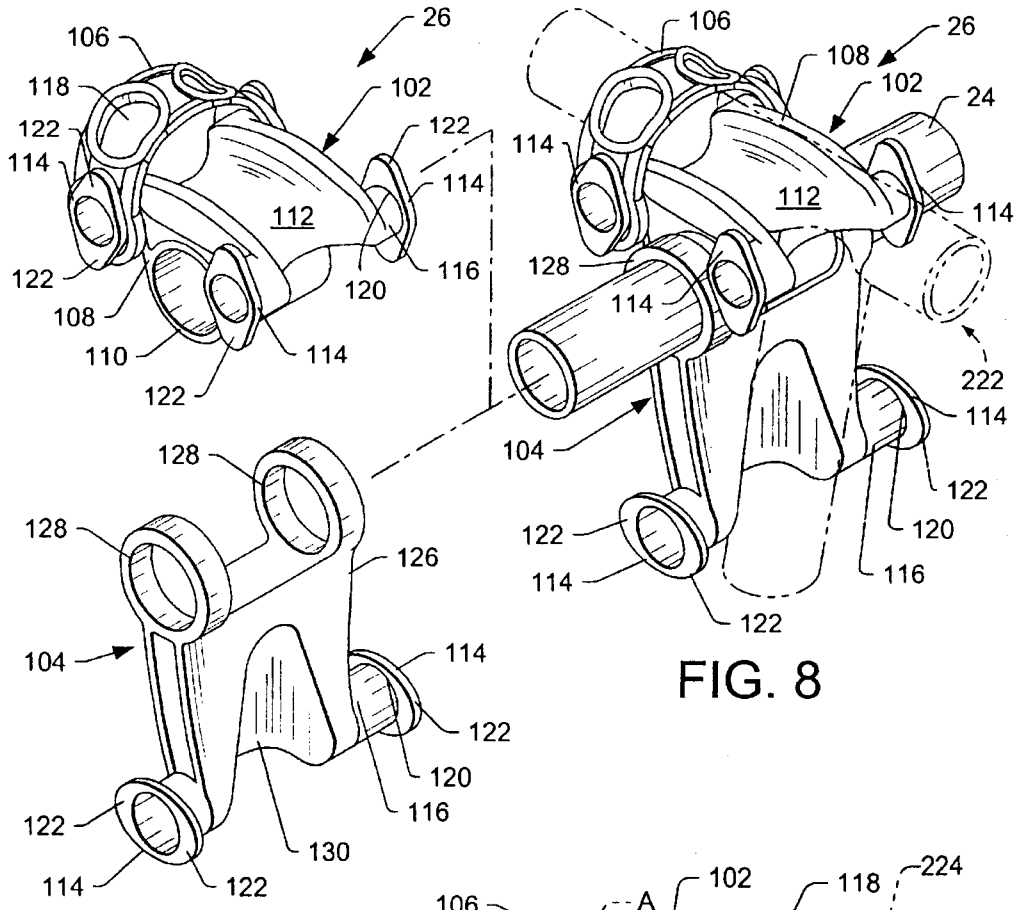
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FIG. 8

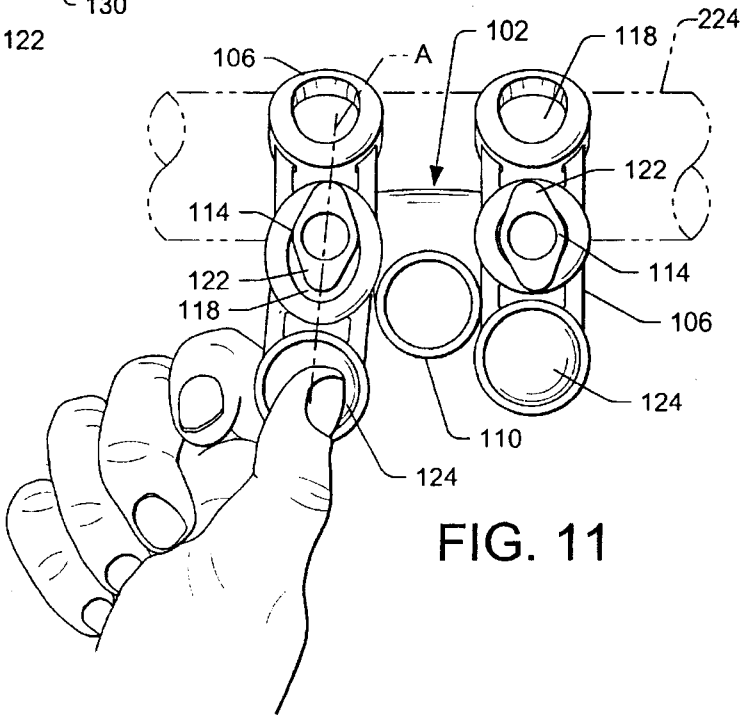
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FIG. 11

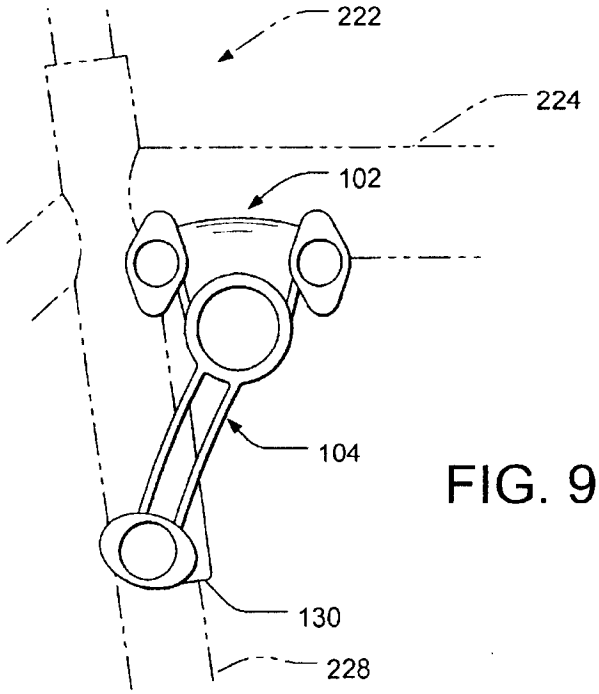

FIG. 9

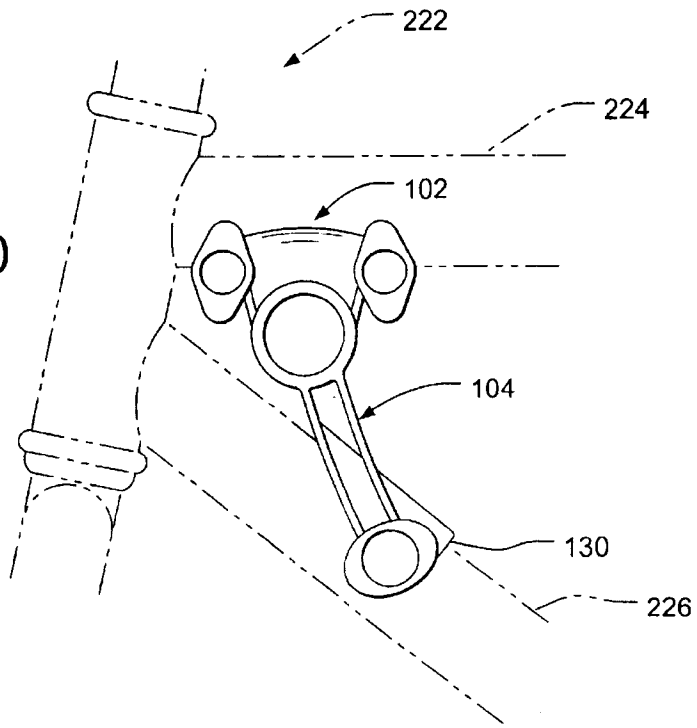

FIG. 10

BICYCLE CARRIER

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation patent application of Ser. No. 09/466,233 filed on Dec. 17, 1999 U.S. Pat. No. 6,286,738 issued on Sep. 11, 2001 titled "Bicycle Carrier" which is hereby incorporated by reference.

FIELD OF THE INVENTION

The present invention relates to bicycle carriers, and more particularly to an adjustable bicycle carrier that may be mounted on the rear of a vehicle.

BACKGROUND

The popularity of recreational cycling has grown substantially in recent years. As a result, the demand for bicycle carriers to transport bikes on cars and other vehicles has also grown.

There are various types of vehicle-mountable bicycle carriers available. One type is mountable on the trunk or other rear portion of a vehicle to carry one or more bicycles adjacent the rear of the vehicle. While some of these carriers are adjustable to mount on different vehicles, the adjustment mechanisms are cumbersome. In addition, even normal acceleration or deceleration of the vehicle can cause the bicycles to sway or become misaligned on the carrier, resulting in damage to the bikes and/or the vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an isometric view of a bicycle rack mounted on a vehicle and supporting a bicycle according to the present invention.

FIG. **2** is a magnified isometric view of the outer side of a housing assembly of the bicycle rack of FIG. **1**, showing the handle extended and rotated to secure the locking member in the second position.

FIG. **3** is an isometric view of the inner side of the housing assembly of FIG. **2**, with the connecting member removed to show the locking member.

FIG. **4** is a magnified detail view of the area enclosed by dashed circle **4** in FIG. **3**.

FIG. **5** is an isometric, partially cut away view showing the locking member in the first position so that the teeth of the locking member engage both the housing and the connecting member to prevent relative pivotal movement between the first and second frame members.

FIG. **6** is an isometric, partially cut away view showing the locking member in the second position so that the teeth of the locking member do not engage the connecting member, thus allowing relative pivotal movement between the first and second frame members.

FIG. **7** is a side elevation of the housing assembly of FIG. **2**, with a portion of the housing cut away to show the slidable and pivotal engagement of the support arm with the housing assembly.

FIG. **8** is an isometric view showing a saddle mount and a stabilizer installed on a support arm and engaging a portion of a bicycle frame (shown in dashed lines). A tie-down member is shown positioned across the bicycle frame and engaging anchors on the saddle mount to hold the bicycle in position. A second saddle mount and a second stabilizer are shown in exploded view.

FIG. **9** is a rear elevation of a saddle mount and a stabilizer showing how the top tube of bicycle frame is supported by the saddle mount, and showing the stabilizer positioned to engage the seat tube of the bicycle frame.

FIG. **10** is a rear elevation of a saddle mount and a stabilizer showing how the top tube of bicycle frame is supported by the saddle mount, and showing the stabilizer positioned to engage the down tube of the bicycle frame.

FIG. **11** is a rear elevation of a saddle mount showing one tie-down member engaged on one anchor, and another tie-down member being stretched to disengage another anchor.

DETAILED DESCRIPTION

A vehicle-mountable bicycle rack according to the present invention is indicated generally at **20**, in FIG. **1**. Bike rack **20** includes an adjustable frame assembly **22** positionable adjacent the rear of a vehicle **200**, and one or more support arms **24** extending from the frame to support at least one bicycle **220** behind the vehicle. Bike rack **20** also includes one or more mounting assemblies **26** adapted to secure bike **220** to the rack and prevent the bike from swaying or becoming dislodged during operation of the vehicle.

An exemplary embodiment of frame assembly **22** is depicted in FIGS. **1–7**, and includes a first frame member **28** configured to contact vehicle **200**. First frame member **28** is generally U-shaped with the central, lower portion of the first frame member being inclined out of the plane of the upper portion. One or more cushioning devices such as cylindrical foam pads **30** typically are attached to the first frame member to protect the vehicle and frame assembly from scratching. First frame member **28** may be constructed out of any suitable material, such as steel tubing, and may be sized as required for compatibility with a wide variety of vehicles.

Frame assembly **22** also includes one or more housings **32** attached to first frame member **28**. As can best be seen in FIG. **7**, each end of the first frame member **28** is received into a housing **32** where it is secured by bolts **34** which pass through the housing. The bolts are fastened to the housing by nuts **36**, as shown in FIG. **3**.

Also included in frame assembly **22** is second frame member **38**, which is generally U-shaped and configured to contact vehicle **200**. Second frame member **38** may include one or more cushioning devices, such as pads **40**, to protect the vehicle and frame member from scratches. Second frame member **38** may be constructed out of any suitable material, including steel tubing, and may be sized as required for compatibility with a wide variety of vehicles. One or more connecting members **42** are attached to second frame member **38**. In the exemplary embodiment, each end of the second frame member is received into a connecting member **42**, where it is secured by a bolt **44** (best seen in FIG. **3**) passing through housing **32**. Bolt **44** is fastened to the housing by a nut

As will be described in further detail below, each connecting member **42** is pivotally coupled to one of the housings **32**, thereby permitting relative pivotal movement between first frame member **28** and second frame member **38**. This allows frame assembly **22** to be adjusted to mount on vehicles of any size or configuration.

Typically frame assembly **22** is adjusted as necessary so that support arms **24** extend in a generally horizontal rearward direction when the frame assembly is positioned on the vehicle. Rack **20** is then mounted onto vehicle **200** by positioning the frame assembly against the vehicle and securing the frame assembly with one or more straps **48**. Each strap is attached to a channel **49** in a housing at one

end, and a hook **50** at the opposite end. Hooks **50** are configured to engage and grip portions of vehicle **200** such as trunk lid **202**. In the exemplary embodiment depicted in FIG. **1**, rack **20** includes four straps, two connected to each housing **32**. One strap from each housing is positioned to hold the rack to the top of trunk lid **202**, while the other strap from each housing is positioned to hold the rack to the bottom of trunk lid **202**. Each strap may also include a buckle **52** or similar device to allow the length of the strap to be adjusted. Once the rack is positioned on the vehicle and the hooks are arranged as desired, the straps may be tightened to hold the rack securely on the vehicle.

While one exemplary method of mounting rack **20** on a vehicle has been shown and described, it will be appreciated that there are many other ways of mounting the rack within the scope of the invention. As one example, the straps may be arranged differently depending on the configuration of the vehicle. Other examples include, using a different number of straps, or holding the rack on the vehicle by fastening methods other than straps. Focusing particular attention now on FIGS. **2–6**, the pivoting connection between housing **32** and connecting member **42** will be described in greater detail. Connecting member **42** includes an annular portion **54**, which is received into a circular aperture **56** in the side of the housing. Bolt **44** passes through both housing **32** and connecting member **42** to hold annular portion **54** within aperture **56**. Bolt **44** also passes through locking member **58**, which is disposed within the housing and selectively movable between a first position and a second position. In the first position, locking member **58** engages both the housing and the connecting member to prevent relative movement therebetween. In the second position, the locking member is disengaged from the connecting member, thus allowing the connecting member to rotate or pivot within the aperture.

It will be appreciated by those of skill in the art that locking member **58** may be configured to engage the housing and the connecting member in a variety of ways. In the exemplary embodiment, locking member **58** is in the form of a wheel having a plurality of grooves or teeth **60** across its outer circumference. Housing **32** includes an inner surface **62** having a plurality of teeth **64** configured to interlock with teeth **60** of locking member **58**. Thus, the locking member fits within the inner surface of the housing and is restrained from rotating within the housing by the engagement of teeth **60** with teeth **64**. However, the locking member remains free to slide along its central radial axis within the housing.

Annular portion **54** of connecting member **42** also includes an inner surface **66** having a plurality of teeth **68**. Surface **66** and teeth **68** are configured to receive the locking member and interlock with teeth **60** to prevent relative rotation between the connecting member and the locking member. However, the locking member remains free to slide in and out of the connecting member along the central radial axis.

FIGS. **5** and **6** best illustrate the engagement of the locking member with the housing and the connecting member. FIG. **5** shows the locking member in the first position, in which the locking member is at least partially received into the connecting member. Teeth **60** of the locking member interlock with teeth **64** of the housing and with teeth **68** of the connecting member to impede relative rotational movement between the connecting member and the housing. As a result, first frame member **28** is prevented from pivoting relative to second frame member **38**. However, in FIG. **6**, locking member **58** has been moved to the second position in which the teeth of the locking member are disengaged from the teeth of the connecting member. Thus, the connecting member is free to rotate relative to the locking member and the housing. As a result, first frame member **28** may be pivoted relative to second frame member **38**.

It will be understood that to allow substantial pivotal movement between the first and second frame members, both connecting members must be rotatable relative to their corresponding housings. Thus, to adjust the frame assembly, the user disengages each locking member from the corresponding connecting member, pivots the first and/or second frame member as desired, and then re-engages each locking member with the corresponding connecting member to lock the frame assembly in the desired configuration. In the exemplary embodiment, each locking member, connecting member, and housing contains a relatively large number of teeth to allow the frame assembly to be adjusted in relatively small increments. Alternatively, each locking member, connecting member, and housing may be constructed with a relatively small number of teeth to correspond to just a few selectable angular positions between the frame members.

As also shown in FIGS. **5** and **6**, frame assembly **22** also includes a biasing member **70** disposed within the housing to urge the locking member toward the first position. In the exemplary embodiment, biasing member **70** is in the form of a compression spring positioned around bolt **44** and against the side of locking member **58** opposite the connecting member. Spring **70** is compressed between the locking member and the wall of housing **32** to urge the locking member toward the first position to engage the connecting member.

A handle **72** extends through the housing and is coupled to the locking member to allow the user to move the locking member to the second position by pulling the handle away from the housing. Handle **72** includes two arms **74** which extend through slots **76** in housing **32**, and through corresponding slots **78** in locking member **58**. As can best be seen in the detail view of FIG. **4**, each arm **74** extends through slot **74** to the other side of the locking member. A deflectable lip **80** is formed on the arm to abut against and grip the edge of slot **78** so that the locking member is pulled in the direction of biasing member **70** when the handle is pulled outward away from the housing. While it is within the scope of the invention for locking member **58** to be attached to handle **72** by any suitable method, the arm and lip structure described and depicted in the exemplary embodiment provides for easy assembly by simply aligning slots **78** with arms **74**, and pressing the locking member inward against spring **70** until lips **80** snap over the edges of slots **78**.

In the exemplary embodiment, the locking member is securable in the second position against the urging of the biasing member, to allow the user to adjust the frame assembly without having simultaneously to hold handles **72** away from the housings. As shown in FIG. **2**, each slot **76** includes a notch **82** configured to receive a ledge **84** on arms **74**. Ledges **84** prevent arms **74** from passing through slots **76** unless the arms are aligned with notches **82**. Thus, to secure the locking member in the second position, the user pulls handle **72** outward from the housing and rotates the handle so that arms **74** slide along slots **76** away from notches **82**. When the user releases the handle, ledges **84** strike the edges of slots **76** and prevent the locking member from returning to the first position under the urging of spring **70**. FIG. **2** shows the handle pulled outward and rotated to prevent the handle from being pulled back toward the housing by spring **70**. Thus, the user can disengage the locking members on each side of the frame assembly and then adjust the frame assembly as desired without having to hold the handles away

from the housings. Once the frame assembly is adjusted to the desired angular configuration, the handles can be rotated to align arms **74** with notches **82** and then released, at which point spring **70** presses the locking member back into engagement with the connecting member to lock the frame assembly in the desired configuration.

As shown in FIG. **4**, locking member **58** includes a plurality of ribs **86** disposed adjacent slots **78**. Ribs **86** are adapted to slightly impede rotation of arms **74** in slots **78**. The ribs do not prevent the user from rotating the handle to secure the locking member in the second position. However, once the user has rotated the arms across the ribs, the ribs prevent the handle from accidentally rotating in the opposite direction and allowing the locking member to return to the first position. Arms **74** and/or ribs **86** may be rounded to allow the arms to rotate relatively smoothly past the ribs when the user rotates the handle.

As described above, frame assembly **22** is easily adjustable to be securely mounted on virtually any type and configuration of vehicle. The various parts of the frame assembly may be constructed of any material suitable for outdoor use and possessing the necessary structural strength to allow rack **20** to support the weight of one or more bicycles. While housing **32**, connecting member **42**, locking member **58**, and handle **72** typically are constructed of a molded plastic such as nylon, other materials are also suitable.

Turning now to FIG. **7**, it can be seen that rack **20** includes support arms **24** coupled to each housing **32** by a sliding, pivoting connection. Support arms **24** may be constructed out of any suitable material, such as steel tubing. In the exemplary embodiment, each support arm **24** includes an elongate slot **88** adjacent one end of the arm. A bolt **90** passes through the housing and through slot **88** to couple the support arm to the housing. A nut **92** (best seen in FIG. **3**) holds the bolt in place. The slot-and-bolt connection of support arm **24** to housing **32** allows the support arm to pivot between a stowed position, indicated by dashed lines in FIG. **7**, and an extended position, indicated by solid lines in FIG. **7**. When in the extended position, the slot-and-bolt connection allows the support arm to be slid into a socket **94** within the housing. When the support arm is received into the socket, the housing engages the support arm and prevents pivotal movement of the support arm about bolt **90**, thereby maintaining the support arm in the extended position to support bicycle **220** adjacent the vehicle.

Support arm **24** also includes a spring-loaded, retractable catch or pin **96**, which is configured to protrude through a hole **98** in housing **32** when the support arm is received in the socket. Thus, the pin prevents the support arm from sliding out of the socket accidentally. When the user wishes to move the support arm from the extended position to the stowed position, the user presses the pin inward against the action of the spring, and then slides the support arm out of the socket. As shown in FIG. **2**, housing **32** may be formed to include a depression **100** adjacent hole **98** to allow the user to press pin **96** inward. Additionally, pin **96** may be formed with a rounded end to allow it to pass through hole **98** without snagging. In any event, once the support arm is removed from the socket, it can be pivoted to the stowed position. When pin **96** clears housing **32**, it will move outward to abut against the side of the housing and maintain the support arm in the stowed position. To pivot the support arm back to the extended position, the user first presses the pin inward to clear the housing, and then pivots the support arm upward.

It will be appreciated that the exemplary embodiment of rack **20** described herein may be substantially collapsed for storage when not in use. As described above, the first and second frame members may be pivoted together to extend in a single general direction, and then locked in that configuration. Additionally, the support arms may be pivoted to the stowed position adjacent and generally parallel to the first frame member, leaving rack **20** in a relatively flat configuration.

Turning attention now to FIGS. **8–11**, rack **20** also includes one or more mounting assemblies **26** adapted to secure one or more bikes to support arms **24**. Each mounting may comprise different components depending on the application. In the exemplary embodiment shown in FIG. **1**, each mounting assembly includes a saddle mount **102**, a stabilizer apparatus **104**, and one or more tie-down members **106**. It will be appreciated, however, that some or all of the mounting assemblies may omit one or more of these components. As one example, a particular mounting assembly may omit a stabilizer and include only a saddle mount and tie-down member. As another example, the saddle mount and/or the stabilizer may be configured to grip a bicycle without the need for a tie-down member.

As is well known in the art, bicycles typically include a frame **222** having a top tube **224**, a down tube **226**, and a seat tube **228**. Top tube **224** extends generally forwardly and horizontally from proximate the bicycle seat to proximate the handle bars. Down tube **226** typically is coupled to the top tube proximate the handle bars and extends downwardly and rearwardly toward the pedal sprocket. Seat tube **228** typically is coupled to the top tube proximate the seat and extends generally downwardly to the pedal sprocket.

Saddle mount **102** is disposed on support arm **24** to receive and engage a portion of top tube **224** and retain the bike in a selected longitudinal position on the support arm. As shown in FIG. **1**, saddle mounts typically will be disposed on both support arms and aligned to receive the top tube of a single bike. Thus, the bike is supported above the ground and retained in a stable position behind the vehicle during travel. In the exemplary embodiment, each saddle mount includes a unitary body **108** formed of molded Santoprene rubber or other suitable material adapted to grip the bike frame without causing scratches or other damage.

Body **108** is formed to define a cylindrical collar **110** adapted to fit over and engage a support arm **24**, and a channel **112** extending into the body. To install a saddle mount on a support arm, the user slides the collar along the support arm to the desired location, and then rotates the saddle mount until the channel is aligned in the desired orientation. Typically, channel **112** is oriented above the support arm to allow the top tube of the bicycle to rest in the channel. Channel **112** is formed as an elongate, parabolic trough adapted to accept top tube **224**. The channel is oriented in a direction generally transverse to collar **110** so that the channel extends generally across the support arms when installed on the rack. In the exemplary embodiment, the sides of channel **112** are sized to extend partially up the sides of a top tube resting in the channel. Alternatively, the sides of channel **112** may be larger or smaller as desired. In any event, channel **112** grips top tube **224** and retains the bicycle in a stable longitudinal position along the support arm during operation of the vehicle.

To prevent top tube **224** from being dislodged accidentally, one or more tie-down members **106** may be positioned over the top tube and fastened to saddle mount **102**. In the exemplary embodiment, each saddle mount includes one or more anchors **114** extending from body **108**. Anchor **114** includes a circular base **116** sized to fit within

circular apertures **118** formed in tie-down member **106**. Each anchor has a distal end **120** spaced from body **108**, and one or more flanges **122** arranged about the distal end. Flanges **122** are arranged generally along a single transverse axis A to form an oval or elongate rim. Flanges **122** prevent the tie down members from slipping off circular base **116**. Tie-down members **106** typically are made of a stretchable material (e.g. Dynaflex G7431 rubber), and must be stretched along axis A to allow the apertures to pass over the flanges. Thus, the tie-downs member cannot accidentally become disengaged from the anchors unless the tie-down members are stretched to clear the flanges.

Referring to the tie-down member on the left in FIG. **11**, a user may secure the tie-down member to an anchor by hooking one edge of a selected aperture around one flange, and then pulling the tie-down member directly away from the hooked flange (i.e., along axis A). When the tie-down member is pulled along axis A, it will stretch along axis A causing the selected aperture to stretch over the opposite flange. Once the aperture clears the opposite flange, the user presses the tie-down member inward over the flange, and then releases the tie-down member to return to its unstretched condition, illustrated by the tie-down member on the right in FIG. **11**. Tie-down member **106** may include a handle or tab **124** to allow the user to grip the tie-down member more easily. The user disengages the tie-down member by reversing the above steps. In one embodiment, the tie-down members are formed of a different, more flexible material than the saddle mounts to prevent the anchors from bending when a tie-down member is being stretched over the flanges.

In the exemplary embodiment, each saddle mount **102** includes two pairs of anchors **114**, with one pair disposed adjacent opposite sides of one end of channel **112**, and the other pair disposed adjacent opposite sides of the other end of channel **112**. Nevertheless, it will be appreciated that other configurations are also within the scope of the invention. For example, a saddle mount may include less than or more than two pairs of anchors. In addition, it may not be necessary to engage a tie-down member to both pairs of anchors to hold the top tube within the saddle. Similarly, while tie-down members **106** are described above as being separate and removable from saddle mounts **102**, an alternative embodiment of the invention may include tie-down members which are formed integrally with the saddle mounts. For example, one end of the tie-down member may extend from adjacent one side of channel **112**, and be positionable over top tube **224** to engage an anchor disposed adjacent the opposite side of channel **112**. Furthermore, while bases **116** and apertures **118** have been described and depicted as generally circular, it will be appreciated that these parts may be virtually any shape as desired.

While saddle mounts **102** are configured to retain a bike in a selected longitudinal position on the support arm, it will be appreciated that the bike may tend to swing or sway due to the motion of the vehicle. To protect both the vehicle and bike(s) from damage due to swinging, mounting assembly **26** also includes one or more stabilizers **104** to impede swinging of the bicycle. Each stabilizer includes an integrally formed body **126** with a pair of collars **128** configured to fit over the support arm. As can be seen in FIG. **8**, collars **128** are spaced apart to fit on either side of collar **110** of the saddle mount when the saddle mount and stabilizer are mounted together on the support arm. Collars **128** allow the stabilizer to slide along, and pivot about, the support arm. Because stabilizer **104** is separate from saddle mount **102**, the stabilizer can pivot about the support arm independently of the saddle mount. While both collars **128** and collar **110** are typically configured to fit on support arm **24** tightly enough to prevent the mounting assembly from accidentally sliding off, the support arm may also include a removable cap (not shown) on the end of the support arm to prevent passage of the collars.

Body **126** is formed to define a channel **130** extending at least partially into the body, and may be constructed of any suitable material including nylon. The stabilizer typically is installed on the support arm so that the channel faces out to the side of the vehicle. The channel is configured to receive at least a portion of either down tube **226** or seat tube **228**. The pivoting connection of stabilizer **104** with support arm **24** allows the user to selectively position the stabilizer to engage either the seat tube, as shown in FIG. **9**, or the down tube, as shown in FIG. **10**. When the seat tube or the down tube is received into channel **130**, the sides of the channel prevent lateral swinging of the bicycle frame.

It will be appreciated that stabilizer **104** will provide greater stabilizing moment if it engages either the seat tube or the down tube at a location spaced from the top tube. Thus, in the exemplary embodiment, body **126** is approximately four inches long from the top of collars **128** to the bottom of channel **130**, and engages the seat tube or the down tube at a location substantially spaced from the top tube of the bicycle. It will be appreciated, however, that the stabilizers may be formed either longer or shorter within the scope of the invention.

Stabilizer **104** may also include one or more anchors **114** configured to engage and secure one or more tie-down members. In the exemplary embodiment, the anchors on the stabilizers are substantially similar to the anchors on the saddle mounts so that tie-down members **106** may be secured interchangeably to either the saddle mounts or the stabilizers. Alternatively, the anchors on the stabilizers may be configured differently than the anchors on the saddle mounts for compatibility with different tie-down members. Furthermore, as described above in connection with the saddle mounts, the stabilizers may include other configurations of anchors and tie-down members within the scope of the invention.

In the exemplary embodiment shown in FIG. **1**, rack **20** includes two pairs of mounting assemblies for mounting two bicycles. Alternatively, rack **20** may include only one pair of mounting assemblies for holding one bike, or three or more pairs for holding three or more bikes. Furthermore, while each mounting assembly is illustrated as including both a saddle mount and a stabilizer, it will be appreciated that a single stabilizer per bike may be sufficient to prevent the bike from swinging during travel. Indeed, for bikes with top tubes that are substantially longer than the spacing between the support arms, it may be difficult to engage both the seat tube and the down tube with stabilizers. Thus, in an alternative embodiment, a pair of mounting assemblies may include a first assembly having both a saddle mount and a stabilizer, and a second assembly having only a saddle mount. Since the stabilizer may be pivoted to engage either the seat tube or the down tube of a bike, the bike may be mounted facing either the left or the right of the vehicle regardless of which support arm the stabilizer is installed on. Indeed, it may be desirable, when carrying two or more bikes, to mount adjacent bikes facing in opposite directions so that the handle bars of the bikes do not collide. This arrangement would allow more bikes to be carried because they could be placed more closely together.

While the invention has been disclosed in its preferred form, the specific embodiments thereof as disclosed and

illustrated herein are not to be considered in a limiting sense as numerous variations are possible. Applicants regard the subject matter of their invention to include all novel and non-obvious combinations and subcombinations of the various elements, features, functions and/or properties disclosed herein. No single feature, function, element or property of the disclosed embodiments is essential to all embodiments. The following claims define certain combinations and subcombinations which are regarded as novel and non-obvious. Other combinations and subcombinations of features, functions, elements and/or properties may be claimed through amendment of the present claims or presentation of new claims in this or a related application. Such claims, whether they are different, broader, narrower or equal in scope to the original claims, are also regarded as included within the subject matter of applicants' invention.

We claim:

1. A bicycle rack for carrying a bicycle on a vehicle, wherein the bicycle has a top tube, a down tube, and a seat tube, comprising

a frame attachable to the rear of the vehicle and configured to support the bicycle adjacent the vehicle,

at least one arm extending from the frame,

a saddle mount having a collar for receiving the arm and a trough for supporting the top tube of the bicycle, the trough having first and second opposing sides,

at least one strap anchored to the first side of the trough, the strap being configured for selective attachment to the second side of the trough, wherein the trough and the strap together are configured to bind and encircle the circumference of a top tube of a bicycle,

a stabilizer pivotally mounted on the arm, the stabilizer having a channel for engaging a down tube or a seat tube of the bicycle, wherein the saddle mount and the stabilizer are integrated so that they slide together along the arm, but are permitted to rotate independently around the arm to accommodate different angles between a top tube and a down tube or a seat tube.

2. The rack of claim **1** further comprising

a strap attached to the stabilizer configured to bind a down tube or a seat tube in the channel of the stabilizer.

3. The rack of claim **1**, wherein the stabilizer has two cylindrical collars configured to engage the arm on opposite sides of the collar of the saddle mount.

4. The rack of claim **1**, wherein the trough on the stabilizer is elongate.

5. The rack of claim **1**, wherein the trough has an elongate parabolic shape.

6. The rack of claim **1**, wherein the at least one strap on the saddle mount has an end that is permanently connected to the first side of the trough, a fastener being provided on the second side of the trough so that the strap can be selectively coupled to the fastener to retain securely the top tube of the bicycle in the trough.

7. The rack of claim **1**, wherein the saddle mount has two straps and a fastener for each strap.

8. The rack of claim **1**, further comprising

a second arm extending from the frame, a second saddle mount being mounted on the second arm.

9. The rack of claim **8**, further comprising

a stabilizer mounted on the second arm adjacent the second saddle mount.

10. A bicycle rack for carrying a bicycle on a vehicle, wherein the bicycle has a top tube, a down tube, and a seat tube, comprising

a frame attachable to the rear of the vehicle and configured to support the bicycle adjacent the vehicle,

at least one arm extending from the frame,

a saddle mount having a collar for receiving the arm, the collar having a top side, and an elongate trough for supporting the top tube of the bicycle, the trough being positioned tangentially relative to the top side of the collar without extending around the circumference of the collar, and a stabilizer pivotally mounted on the arm, the stabilizer having a channel for

engaging a down tube or a seat tube of the bicycle, wherein the saddle mount and the stabilizer are integrated so that they slide together along the arm, but are permitted to rotate independently around the arm to accommodate different angles between a top tube and a down tube or seat tube.

11. The rack of claim **10**, wherein the trough has first and second opposing sides, further comprising

at least one strap anchored to the first side of the trough, the strap being configured for selective attachment to the second side of the trough, wherein the trough and the strap together are configured to enclose the entire circumference of a top tube of a bike.

12. The rack of claim **10**, further comprising

a strap attached to the stabilizer configured to bind a down tube or a seat tube in the channel of the stabilizer.

13. The rack of claim **10**, wherein the stabilizer has two cylindrical collars configured to engage the arm on opposite sides of the collar of the saddle mount.

14. The rack of claim **11**, wherein the at least on strap on the saddle mount has an end that is permanently connected to the first side of the trough, a fastener being provided on the second side of the trough so that the strap can be selectively coupled to the fastener to retain securely the top tube of the bicycle in the trough.

15. The rack of claim **10**, wherein the saddle mount has two straps and a fastener for each strap.

16. The rack of claim **10**, further comprising

a second arm extending from the frame, a second saddle mount being mounted on the second arm.

17. The rack of claim **16**, further comprising

a stabilizer mounted on the second arm adjacent the second saddle mount.

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